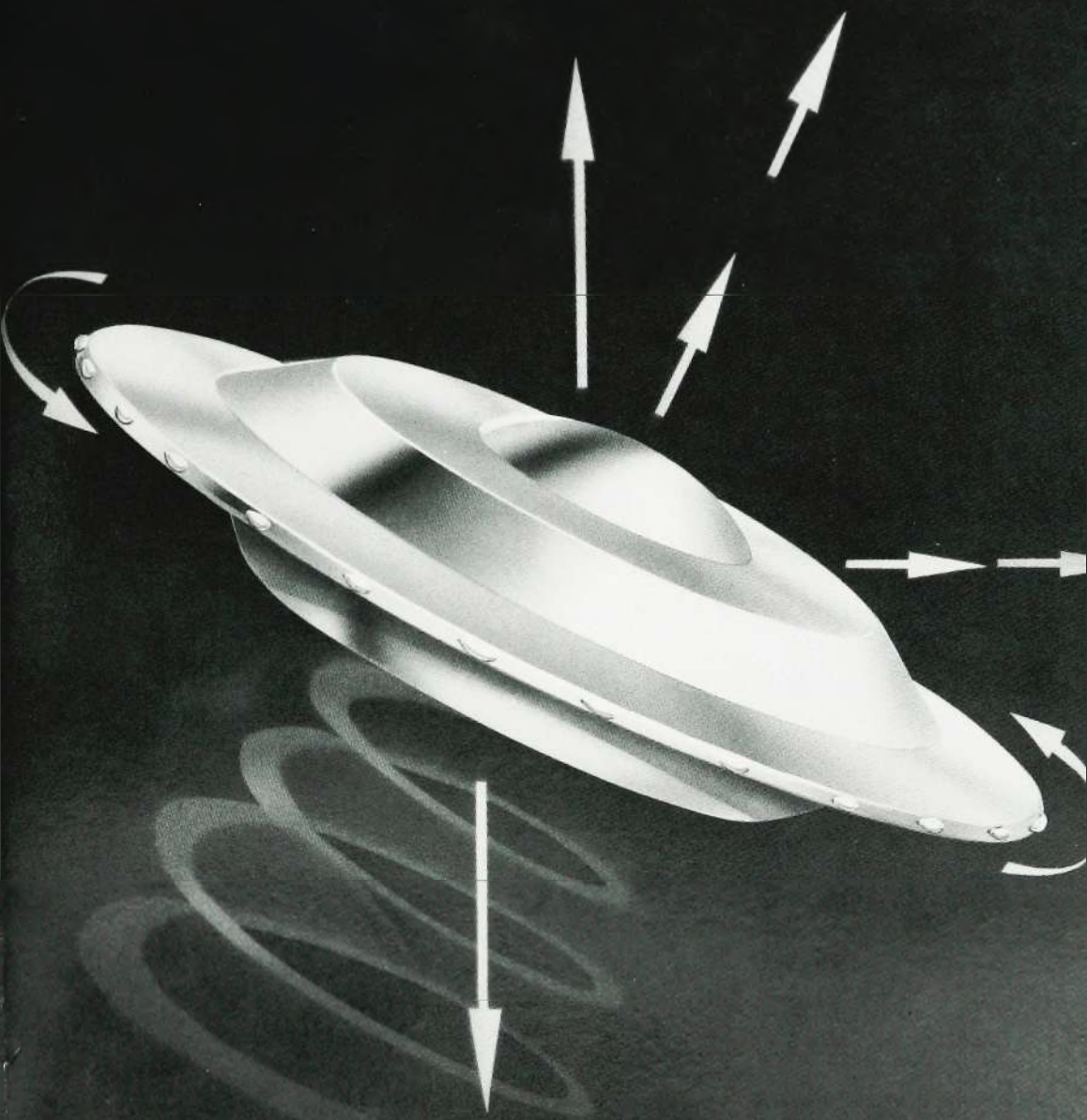
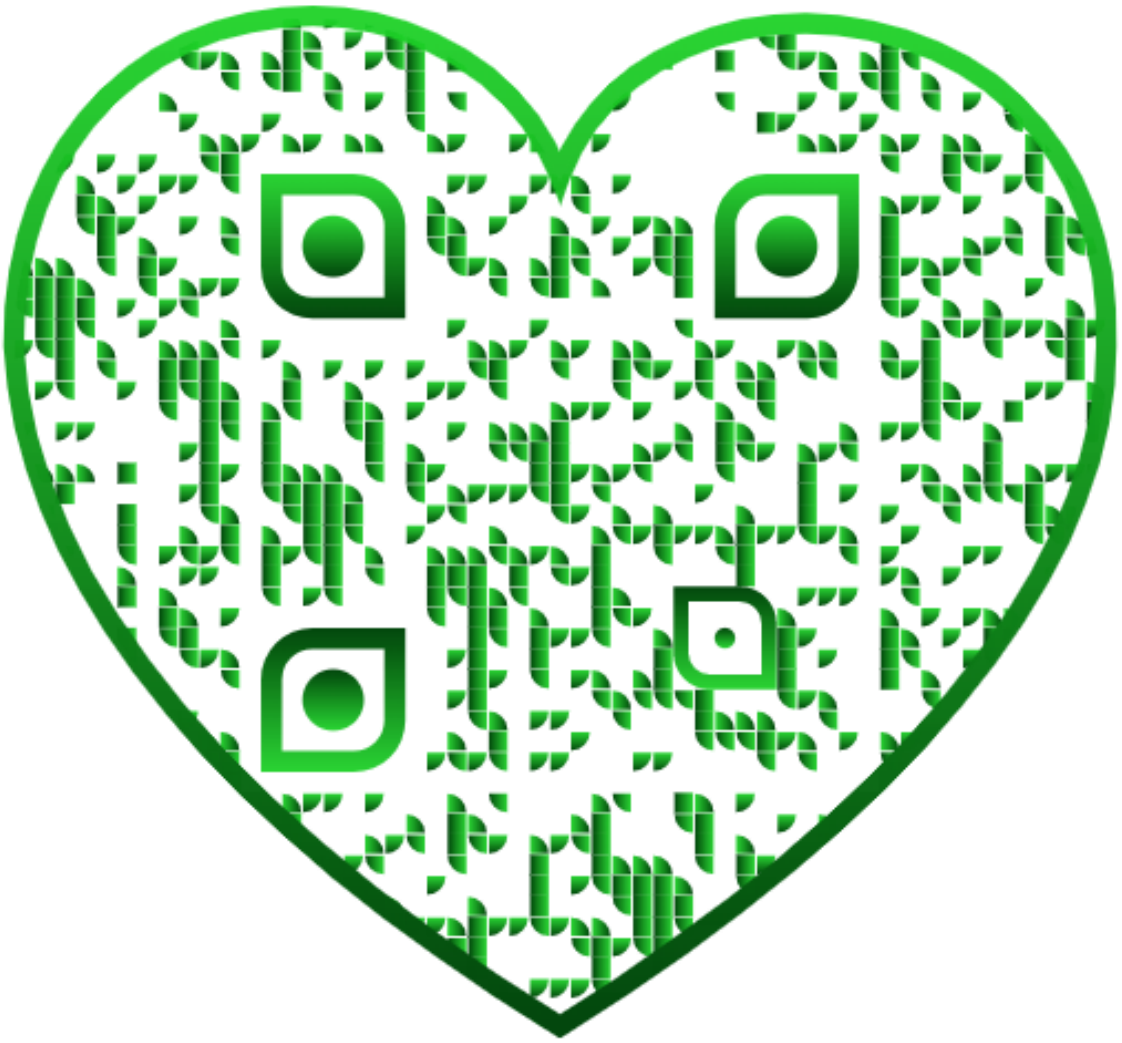
TO CATCH A FLYING STAR

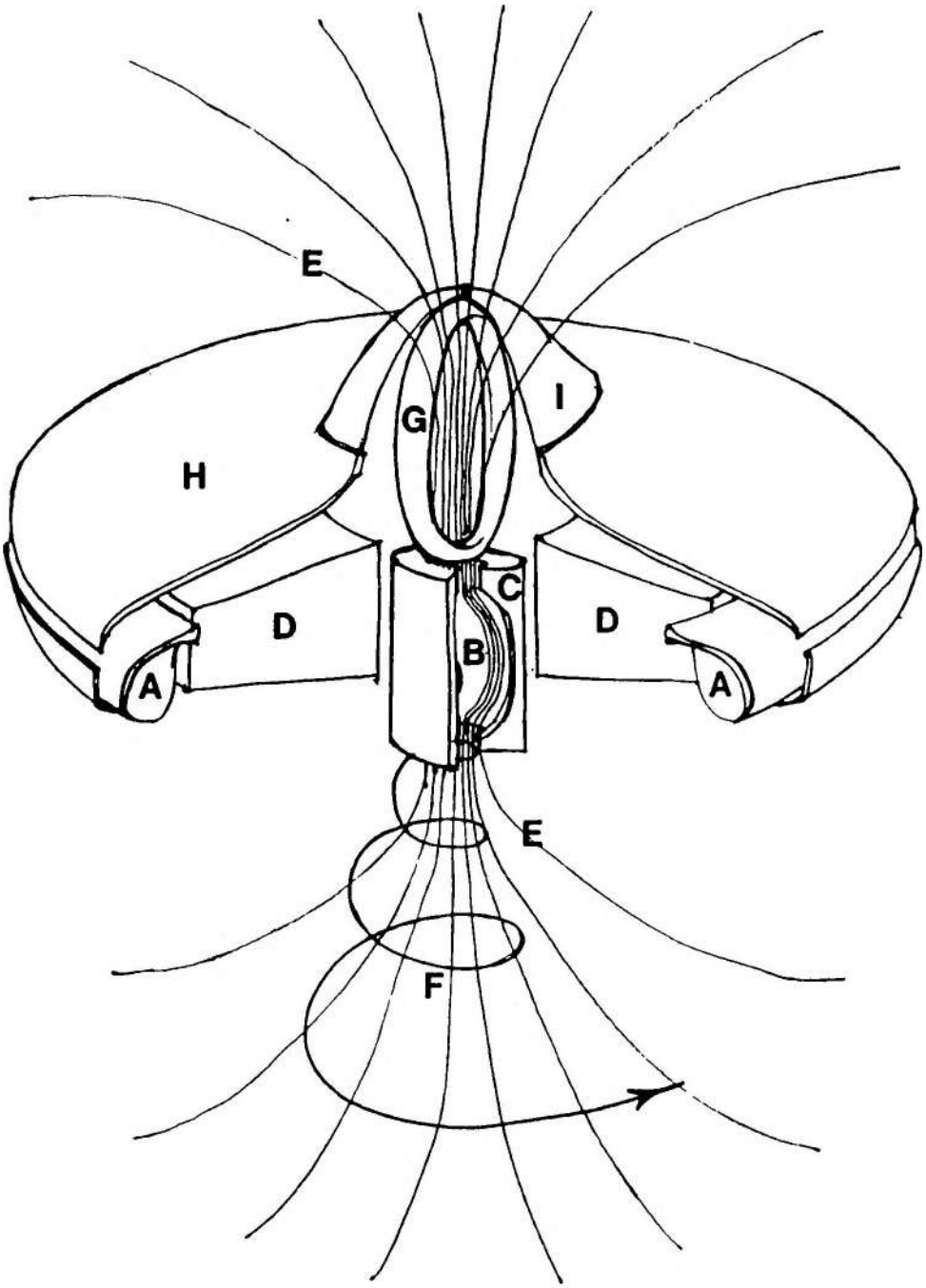
A SCIENTIFIC THEORY OF UFO'S



JOHN ACKERMAN



TO CATCH A FLYING STAR - A Scientific Theory of UFOs



Proposed disc design summary: The labeled parts are as follows: (a) superconducting loop, (b) fusion combustion chamber, (c) magnetic bottle shaping elements, (d) payload or cabin space, (e) magnetic field lines exterior to vehicle, (f) trajectories of charged combustion products spiraling about the magnetic field lines at the "exhaust", (g) secondary current loop for stabilization and control, (h) rotating annular section for gyroscopic stabilization, and (i) the cockpit.

TO CATCH A FLYING STAR
A Scientific Theory of UFOs

by John Ackerman

with Foreword by Walter H. Andrus, Jr.

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FOREWORD

To Catch a Flying Star is an intriguing title for a book as it might provoke the impression that it is delightful and entertaining fiction. However, the sub-title *A Scientific Theory of UFOs* dispels any prior misconception, since it is basically a technical treatise on a hypothetical propulsion system for a "flying saucer" or an Unidentified Flying Object (UFO). Even though the book's major appeal may be to scientists, engineers, or academicians who are seriously seeking the technical answers to the power and maneuverability of the elusive UFO, anyone interested in the UFO phenomenon will be fascinated with the author's observations, and non-technical explanation of this most baffling mystery of the Space Age.

Obviously, to propose a theoretical hypothesis of this complexity, the author has had to draw upon many disciplines of study such as mathematics, electricity, chemistry, physics, magnetism, and astronomy. This also includes an exposure to the advanced work of Albert Einstein. The mathematics and formulas presented are essential for readers conversant with these disciplines to understand Mr. Ackerman's theoretical model.

As the International Director of the Mutual UFO Network (MUFON), I heartily encourage John Ackerman and invite other dedicated researchers to study the author's hypothesis. No claims are being advanced as to the factual authenticity of the author's work, because he is the first to proclaim that giant steps in technology are required to utilize the theories submitted. Based upon a history of the presence of a magnetic field associated with UFOs in close proximity to witnesses and

vehicles, Mr. Ackerman has endeavored to build upon this characteristic to explore an electromagnetic means of propulsion. Intensive research into magnetic field principles has the potential to yield favorable results.

MUFON, as a worldwide UFO organization, is dedicated to the express purpose of seeking answers to four basic questions pertaining to the enigma known as Unidentified Flying Objects:

1. Are UFOs some form of spacecraft controlled by an advanced intelligence, conducting a surveillance of our Earth, or do they constitute some unknown physical or psychological manifestation that is not understood by twentieth century science?

2. If UFOs *are* found to be extraterrestrial craft controlled by some unknown intelligence, what is their method of propulsion? Or, if they have developed a technique for operating in another dimension, how is that accomplished?

3. Postulating that they may be controlled by an extraterrestrial or nonterrestrial intelligence, where do they originate - in our physical Universe or possibly in another dimension?

4. Assuming that some of the craft might be piloted by beings (humanoids, entities), what can we learn from their apparently advanced science and civilization through study or possibly through direct communications with the occupants of these vehicles that will benefit mankind on the planet Earth?

Obviously, these far-reaching questions present a tremendous challenge to every facet of science, sociology, and even religion for the residents of Planet Earth. In his book, *To Catch a Flying Star: A Scientific Theory of UFOs*, John Ackerman has directly addressed the first three questions and accepted the challenge of trying to solve the second. In Chapter 2, he discusses the extraterrestrial hypothesis proposed in the third question.

Mr. Ackerman has studied the flight characteristics, physical shape and construction, of UFOs, as well as the numerous

light, magnetic, chemical, heat and radiation factors reported during the past forty years in order to incorporate these observations into his hypothetical design. Over the years MUFON has received numerous designs from enthusiastic inventors depicting their proposed flying saucers. If their idea seems to have merit and warrants further evaluation, it is submitted to aerospace engineers, physicists and specific scientists on the MUFON Advisory Board of Consultants who hold doctorates in their individual fields of expertise. Two of these consultants have approached the propulsion method using some of the same principles enumerated by John Ackerman. One has received a patent for his idea from the U.S. Patent Office. Due to the logistics of meeting publishing schedules, Mr. Ackerman's extensive manuscript was not evaluated by MUFON Consultants.

Superconducting material and devices play a prominent role in the author's propulsion design. He readily acknowledges that present-day science has not achieved such a superconductor, but is making significant strides toward this goal.

A recent *New York Times* service press release, datelined Los Angeles, provided an update on the technical status of superconductivity relevant to John Ackerman's proposal:

> A team of scientists from the California Institute of Technology announced September 25, 1988, they had developed a long sought comprehensive theory explaining key aspects of superconductivity - the phenomenon in which certain materials are able to conduct electricity without resistance.
>
> The theory appears to rule out the possibility that currently known superconductors could ever be made to work at room temperature, a requirement for many of the technological marvels envisioned when researchers discovered the new class of materials that are superconductors at relatively high temperatures.
>
> But the Caltech scientists predicted that their theory, based upon complex calculations involving quantum mechanics of bonds be-

> tween atoms, eventually would guide experimenters to the development of materials that would become superconductive at much higher temperatures than is possible with existing materials.
>
> An outline of the theory was presented at the annual meeting in Los Angeles of the American Chemical Society by Dr. William A. Goddard III, a professor of chemistry and applied physics at Caltech, and three of his graduate students, Guanhua Chen, Yuejin Guo, and Jean-Marc Langlois.
>
> Superconductivity has been exploited in many scientific instruments, astronomical sensors, and such chemical diagnostic techniques as nuclear magnetic resonance, which is used to view the brain and other previously inaccessible parts of the human body.
>
> But the theory may disappoint engineers and others who had hoped that recent advances would lead to trains levitated and propelled by superconducting magnets or to power lines in which current flows without loss.

As a physicist, Mr. Ackerman has evoked the scientific method in his theory; that is, using principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.

In this foreword, I not only commend him for his scholarly work, but enthusiastically encourage him to share his ideas with others who have been challenged by the identical problem. *To Catch a Flying Star: A Scientific Theory of UFOs* constitutes John Ackerman's contribution to the resolution of the perplexing mystery of the power source for Unidentified Flying Objects. Even though present-day science has been unable to produce a craft that simulates the flight characteristics of a UFO, the hypothetical theory herewith presented may be the key to unlocking the secret or motivating other scientists to combine their talent and expertise to discover the solution.

The study of the UFO phenomenon over the past forty years has provided overwhelming evidence of the existence of

UFOs, whatever they may be. I have predicted for many years that our present physics books may have to be revised to include new theories and principles when the unique power source for these craft is duplicated. The challenge is of such magnitude that the nation or aerospace company that produces the first functional spacecraft of this nature will stand head and shoulders above everyone on Planet Earth. They will undoubtedly become the undisputed leader in the exploration of our Solar System and any Galactic neighbors in the Milky Way.

Walter H. Andrus, Jr.
International Director
Mutual UFO Network, Inc. (MUFON)
103 Oldtowne Road
Seguin, Texas 78155-4099 U.S.A.

PREFACE

UFOs constitute one of the most profound modern mysteries. After 40 years of reported sightings and even abductions, there is still no resolution of the puzzle. Many people are impatient with the lack of progress and some have lost interest altogether. To others, the fact that these objects have avoided scientific scrutiny is proof they are not real. Those still interested are tired of explanations such as psychic phenomena, other dimensionalities, and "antigravity", a force for which there is no experimental evidence. The so-called scientific investigations have merely white-washed the issue. Thinking people all over the world want something more substantial on which to found their beliefs.

Based on the mass of observational data accrued in the last 40 years, particularly hundreds of close-encounter cases with multiple witnesses, we reason that UFOs are real physical objects, probably originating from advanced civilizations associated with nearby stars. Given this starting point, we use the scientific method to construct a theory of how these spacecraft function - strictly within the laws of physics as we know them. this includes the method of propulsion, stability, control, and the power source. This effort involves a combination of deductive and inductive reasoning - deduction, to interpret the observed clues, and induction, to synthesize a consistent and innovative spacecraft design using the laws of physics. Out of this process several new ideas evolve which can be verified in the laboratory.

A variety of specific observations are then explained in light of the theory. Finally, a two-pronged approach to the UFO problem is proposed: The first one is the design of specific measurements to be made on UFOs, both at short and long range, aimed at corroborating the theory and consequently the physical reality of these objects. The second is the use of computer simulations and laboratory experiments to investigate the proposed vehicle design, thereby bringing us one step closer to the realization of our own starships.

The author is indebted to Rochelle Pripstein of Chalfont, Pennsylvania, for her diligence and care in preparing illustrations for this book.

John Ackerman

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INTRODUCTION

The UFO phenomenon - the sighting of thousands of unidentified flying objects each year - is the enigma of the 20th Century. In a period of unprecedented technological growth when "science" can apparently do anything it has a mind to do - destroy the largest city in the world with a single bomb, send men to the moon, cure diseases which have been the scourge of mankind for centuries - it has not yet laid a glove on the elusive UFO. This is so unbelievable that most scientific organizations advocate that all UFO reports can be explained as misinterpretations of natural phenomena or man-made objects, reasoning that if UFOs were "real," we would certainly have captured an artifact by this time. Since none have been found, or at least none that can be proven to be artifacts, they reason that UFOs don't exist.

This head-in-the-sand attitude of the scientific establishment is exemplified by the supposedly scientific study of UFOs funded by the U. S. Air Force and "performed" by the University of Colorado. This was exposed by members of the research group itself as being a deliberate attempt to lay the subject of UFOs to rest permanently. Fortunately it did not succeed - how could it? People all over the world continue to observe UFOs, and in spite of the many misinterpretations which are made, there is a continuous kernel of observations, particularly those at close range with multiple observers, lasting longer than ten minutes which absolutely cannot be disregarded.

One of the greatest revolutions in the history of science was the period during which the establishment was gradually, by the sheer weight of evidence, forced to accept the fact that the earth was not the center of the physical universe, but merely one planet of many which revolved around the sun. This could be called the Copernican revolution after the astronomer Copernicus who first advanced the idea that the earth along with the other planets revolved about the sun. The church taught that if God created man, He would obviously put him at the center of the universe. This concept died hard. The UFO presents the establishment, and the church is still part of it, with an even more profound revolution in our thinking about where we earthlings stand in the hierarchy of things. Men have never interpreted the term "...God created man a little lower than the angels..." to mean that we might be second class citizens in this little corner of the universe. But that is indeed the most logical conclusion that one can come to when faced with the enormous scope and depth of the UFO phenomenon.

The purpose of this book is to advance a theory of how UFOs, the flying machines, operate, in terms of the laws of physics. This is a tractable problem within the scope of modern physics. However because of the very nature of the enigma, questions of "What are they?" have always preoccupied investigators, preventing them from really addressing the part of the problem which can be dealt with using the scientific method. The approach used here is to make the best guess as to what they are, being less encumbered with the burden of the establishment ideas, and to proceed with the aspect of the problem which lends itself to study via the scientific method.

The question of the reality of UFO reports is discussed in Chapter 1 followed by the extraterrestrial hypothesis in Chapter 2. The technological aspects of the theory are developed in the Chapter 3, where a combination of deductive and inductive processes are invoked to develop a fascinating design for a "starship". One beyond our present ability to build but not

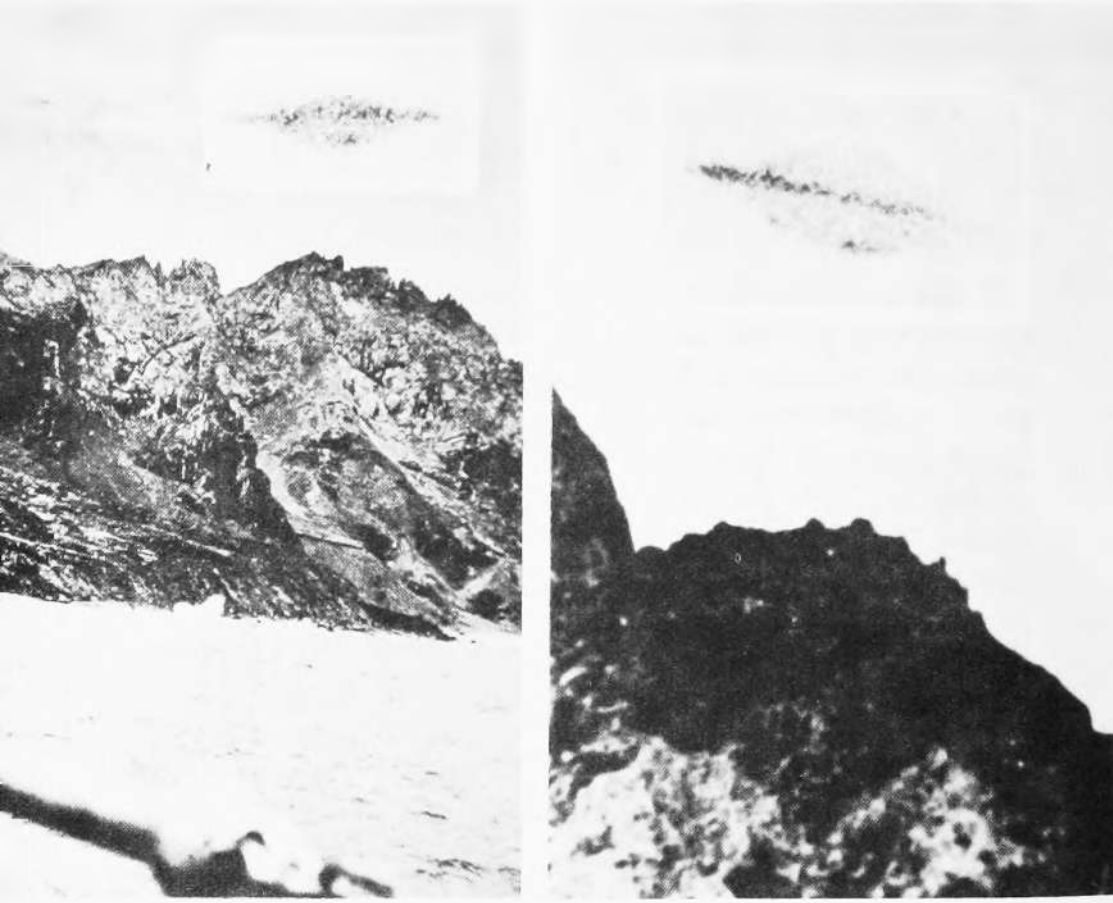
beyond our ability to conceive. Although the magnitude of certain physical quantities such as the superconducting current required by this theory are beyond our present capabilities, this is to be expected in light of the very advanced technology with which we are dealing. A new "electromagnetic engine" is proposed as the power source, which may be applicable to the problem of extracting electrical energy from controlled fusion reactions here on earth. This simple but elegant concept can be verified by relatively modest experiments.

Chapter 4 reviews the sighting data, attempting to correlate the theory with what has actually been observed. A surprising number of seemingly unrelated facts make much better sense in light of the new concepts which constitute the theory.

Chapter 5 deals with astronomical objects, specifically quasars and pulsars, as part of a thought experiment to investigate the question of how the hypothesized vehicles would appear to an astronomer viewing them from great distances. More generally they are included to stimulate the thinking of people in these disciplines along less conventional lines than would the standard technical publications. Most inquiring minds are thirsty for such new ideas but cannot openly espouse more radical notions for fear of censure by their peers. It is difficult to believe that any astronomer, upon first hearing of the discovery of pulsars, did not wonder himself that these were possibly spaceships. Although the LGM (Little Green Men) hypothesis was discussed, it was always mentioned with a tongue-in-cheek tone, to hedge against being considered heretical in the scientific establishment.

Not surprisingly, the theory suggests specific measurements or observations which if they can be made in the vicinity of a real UFO (i.e. an extraterrestrial spacecraft) should prove the theory beyond a reasonable doubt. It is seldom that a new scientific theory can prove itself based on one measurement or experiment but this may be possible in the case at hand because the predicted magnitudes, such as the magnetic field, are enor-

mous compared to any natural or manmade sources. Chapter 6 discusses both these observations and experiments which can be performed in the laboratory to verify the proposed electromagnetic engine. It is by such experiments that man will take his first fledgling steps toward the stars. Ironically, this might occur before we ever lay a hand on the elusive UFOs themselves.



Trindade Island, Brazil - Photographs taken by Almiro Barauna on January 16, 1958 at 12:20 p.m. from the Navy ship Almirante Saldanha. Known as the "IGY Photographs" (International Geophysical Year). Camera: Rolleiflex Model E, f2.8 lens exposure: f8, 1/125 second. The film was developed aboard the ship. Entire crew of ship (100) were witnesses to object and photographer. In this photo the object was flying over the center of the island behind the "Galo Crest" at low speed. The Brazilian Navy conducted the photo analysis and the photographs were released to the press by the President of Brazil. These are considered to be some of the most creditible UFO photographs (Courtesy of Mutual UFO Network, Inc., - MUFON).

1. THE EVIDENCE

The "UFO Problem" to which this book addresses itself is as follows:

"Given the large number of UFO reports and the totality of information contained therein, however noisy, assume the physical reality of these objects and construct a theory which explains the principles by which they counter gravity, propel themselves, and are powered."

The first step is to discuss the observational data on which the theory is based, including the reporting process by which the data are obtained. The latter is important because it is quite different from the process usually associated with scientific investigations. The theory developed in this book will be presented as a series of hypotheses, consistent with the scientific method.

THE SCIENTIFIC METHOD

The various branches of science can be classified as either experimental or observational. The first type includes those disciplines which progress by continuous and patient experimentation in the laboratories of the world. It has been in the laboratory that the foundations of physics have been built up during the last few centuries. Several sciences, however, such as astronomy and cosmology are primarily observational in nature, as opposed to experimental. That is to say that the investigator has no control over the evolution or structure of the events which he studies, thus he cannot be said to *perform* ex-

periments. In spite of this lack of control, these sciences have been characterized by significant progress and indeed some of the most interesting scientific discoveries of the last few decades. How is this possible? The answer is that the observable systems are essentially an ensemble of all possible experiments, each of which is uncontrolled, but the great number, in all stages of development, allow us to formulate and check theories of their evolution. The lack of control of each experiment is compensated by the large number of observable events of all types in all stages of development. Of course the observational sciences draw heavily on the great body of knowledge which has been build up in the experimental sciences, the crucial link being the assumption that the laws of physics are the same in the laboratory as in distant parts of the universe. The UFO problem is also observational in nature, although more difficult than astronomy because of the unpredictable way in which observations occur in both space and time. A better analogy would be the search for rare particles such as super-high-energy gamma rays from space, monopoles, or gravitons, quanta of the gravitational field, since one never knows when or where these events will be observed.

Even in those areas of science where experiments are performed, it is often true that the scientist who devises a successful theory does not perform the experiments himself. Therefore, in spite of the method by which the data were collected, he may never have made a single experimental observation, yet he feels qualified to develop and publish a theory. He accepts the results of other experimenters - perhaps in distant parts of the world, perhaps some that are in conflict with others - and the observations resulting from these experiments become the basis for the theory. In a similar manner, the observations summarized below constitute the pool of information on which this theory of UFOs is based.

The true scientific method involves the following steps:

1. Collect as much information as possible from all available sources.
2. Analyze and weight the information on the basis of the discernible circumstances under which the observations were made.
3. Form a hypothesis based on a knowledge of physics and mathematics, which is consistent with the mass of observed data.
4. Then test to see how well the entire body of present and future experience agrees with the *predictions* of the hypothesis.

The value of the hypothesis rests on its ability to explain the current body of observations and to further predict measurements that will be made in the future. The more observations successfully explained by the hypothesis, the more confidence must be placed in it. The hypothesis is originally speculation, a guess, but an educated guess formed from the observational data on the one hand and a knowledge of science on the other. If we consider the observational evidence as being akin to the clues with which a detective attempts to solve a crime, we would tend to think of the process (of developing a theory) as a deductive one. However, the guess is often a creative, inductive process which involves the combining of previously existing concepts in a new and unique way. Therefore the process, as illustrated by the theory developed herein, is at once both deductive and inductive in nature.

In the case at hand we have felt the necessity of adding a preliminary step to this process, i.e. that of arguing for the physical reality of the observed phenomena on the basis of the statistics, mainly because the observations cannot be made whenever and wherever the investigator wishes. In scientific terms, the events are randomly distributed in space and time. In most scientific experiments, the physical reality of the experiment is generally acknowledged, not because the objects can be seen, but because the experiment or observation is reproducible. For example, before the discovery of the

electron, proton, and neutron, no one had seen these objects and certainly no one knew what they were or where they came from. Nonetheless the experiments involving these particles could be reproduced and the characteristics of these particles could be measured.

OBSERVATIONAL DATA

When people observe a flying object, which they are unable to identify based upon their own knowledge and background, they may report this observation to the local police or some other agency. Naturally many people who make such observations discuss them only with close friends and no report is made. Also many such cases which are reported to the local police are not investigated or passed on to an organization which keeps records of such reports. There is a UFO hot line by which local police departments may pass reports on to organizations such as the Center for UFO Studies founded by the late Dr. Allen Hynek, perhaps the best known UFO writer and lecturer. If a report is recorded, we have the first step needed in collecting information which is necessary for performing a serious study of the matter. However, the very fact that the majority of sightings are not reported is in itself a fact which must be kept in mind.

The report represents a possible UFO but the sighting is not considered a "true UFO" unless an investigation is performed involving experts in areas usually associated with such reports, such as astronomers, military personnel, physicists and psychologists. If these specialists are unable to explain the observed occurrence as either an acknowledged natural or man-made object, it is then *officially* designated a UFO. Unfortunately no organization has the resources to conduct thorough investigations on every report. Furthermore, the investigations which are conducted normally utilize only those volunteer personnel who are available in the area and these individuals or

groups have their own characteristic strengths and weaknesses as well as biases, so that one cannot be assured as to the ultimate correctness of their conclusions. The UFO report becomes a true UFO if the investigator and his colleagues can find no natural phenomenon or man-made object to which it can be attributed. Those objects which *are* identified are sometimes referred to as IFOs.

These procedures all point up the rather large uncertainty or "noise" associated with the UFO phenomenon. This uncertainty is due to a number of factors: doubts concerning the reliability or credibility of the observers; honest misinterpretations of unsophisticated observers; questionable credibility of certain UFO organizations; the unevenness in or lack of investigations; the time lag between the report and the investigation; and the biases of a particular investigator stemming from his technical or personal background. Given the imperfectness of the entire machinery, is there anything really meaningful which can be culled from the mass of data on which to build a theory? The answer is yes, due primarily to the sheer number of reports and the common thread of observed characteristics described over and over again by people in all countries, all walks of life, for more than thirty years.

Organizing the Data

In this section we shall discuss these observational data. Dr. Hynek [Hynek 72] has suggested categories for the classification of UFO reports. We will use these here in order to discuss some statistics of the UFO reports collected by Dr. Hynek's Institute for UFO studies. They are as follows:

1. Nocturnal Lights
2. Daylight Discs
3. Radar-Visual
4. Close Encounters I

5. Close Encounters II
6. Close Encounters III.

The first two are self-explanatory. The third is a special category in which both radar and visual observations are made simultaneously; this could occur during daylight or at night. Close encounters are reports in which the object is sighted close to the earth and to the observer, so that reasonable size and distance estimates can be made by visual reference to familiar terrestrial objects. Close encounters of the first kind are simply this, with no ancillary information. Close encounters of the second kind are those cases in which the observer is close at hand and the object leaves physical traces at the place of the sighting such as imprints in the earth, grass flattened in a circular pattern, broken tree limbs, and killed or stunted plants or animals. Close encounters of the third kind are those in which creatures or beings are observed in close association with the UFO.

The following statistics are based on published summaries of reports catalogued by the Center for UFO Studies. During the period from 1947 to 1976, a total of over 56,000 reports were received. These came from all over the world, but the majority were from the USA, primarily because the reporting channels are more readily available. Over 2400 of these were close encounter cases. In two-thirds of these close encounter cases, the duration of the observation was greater than five minutes. For 360 close encounters of the second kind for which the information is available, 40 percent of the observers were within 50 feet of the object. For over 1000 close encounters of the second kind for which data are available, more than 50 percent involved multiple witnesses.

In spite of the fact that a great number of these cases were not investigated due to inadequate resources, the close encounter cases are of particular importance because there is less likelihood of misidentification of a natural or man-made phenomenon as a UFO, such as aircraft lights, planets, or bal-

loons. These statistics are even more impressive when one realizes that perhaps only one out of ten sightings in this country are reported, particularly with the close encounter cases, for fear of ridicule.

This observational evidence which is the basis of the close encounter cases is too strong and too consistent to be ignored. It confutes the conservative "school" of so-called UFO debunkers who insist that all sightings can be explained as either natural phenomena or man-made objects. Although these conservatives supposedly represent the attitude of the scientific establishment, their approach is not scientific, but dogmatic. Theirs is but a blind attempt to deny something which is obviously very real, because it is not in the text books on which they were weaned. Their desperate attempts at "rational" explanations for UFO reports become more and more futile as the close encounter reports roll in year after year. They represent the dying gasps of the "New Provincialism" - just as the Church in the time of Galileo - clinging desperately to the idea that we are the preeminent species in the universe.

Observed UFO Features

The statistics cited above would not be nearly so impressive if the appearance of reported objects and their actions were random in nature, but this is not the case. Although there are many variations reported, there is a thread of common attributes that runs through the majority of sightings. These features are so common that anyone familiar with the UFO literature takes them more or less for granted. However, it is important that we review these characteristics here, since they represent most of the information on which we must base the theory. The following paragraphs constitute a brief summary of the UFO evidence.

Shape

The shape by far most frequently reported is that of a relatively thick disk such as would be formed by two saucers, one inverted and placed upon another but with some space between them. This may or may not have a dome on top.

The second most common shape is that of a cigar. These are often reported standing on end and emitting small discs from the top or bottom. They may be only a tall stack of discs joined together temporarily.

Size

The size most frequently reported is about 25 to 30 feet in diameter. The most reliable size estimates come from the close encounter case in which by definition the object is close to the earth. Much larger discs, several hundred feet in diameter, have been reported by aircraft at higher altitudes. Although not as common, larger discs are sometimes seen near the earth.

Lights

Lights are often associated with discs. They take on several forms. There is often an extremely bright pulsating light which is sometimes so bright (at night) that it seems to engulf the entire vehicle. Also frequently reported is a scintillating light around the periphery of the vehicle. Thirdly, beams of light are often reported such as would come from a searchlight. In some pursuit cases the UFOs have been observed to extinguish all lights when an aircraft approaches at night.

Surface Material

Most frequently described as metallic similar to burnished aluminum. No rivets or joints of any type are evident. The dome, when present, is often described as transparent or partially so.

Affinities

Locations where sightings occur most frequently are remote areas of locally low population. Reservoirs and electrical transmission lines are the two most specific areas commonly reported. Sightings have been made at many military bases over the years.

Flight Characteristics

UFOs in general commonly exhibit highly characteristic motions in flight. At higher altitudes they have been reported to move in straight lines at speeds well in excess of most aircraft, e.g. several thousand miles per hour but cases are relatively rare in which actual measurements of speed could be made. At moderate altitudes, e.g. a thousand feet, vertical flight profiles have been noted to follow that of the terrain below even though the altitude is more than sufficient to clear the terrain. At yet lower altitudes a tortuous, halting, erratic flight path is often reported with associated extreme attitude changes. This often attracts the attention of the observer since it is so different from the behavior of man-made aircraft. A maneuver sometimes associated with vertical descent is that of a falling leaf. In pursuit cases, rapid vertical ascent, at a rate far in excess of present day aircraft are often reported. Hovering for long periods of time with no apparent noise, exhaust, or buffeting of surrounding objects is extremely common. Precession, that is, the familiar wobbling motion of a child's top is often reported with similar discs. A portion, i.e. an annular section or perhaps the top or bottom "saucer", is often reported as rotating and the speed of rotation is sometimes varied, say, from zero at take-off to a substantial rate as ascent proceeds. Multiple UFOs are often observed flying together in geometrical formations.

Other Motions

There are cases on record in which UFOs are visible while hovering but become "invisible" when moving rapidly to another position, again becoming visible when they stop moving. Vehicles moving well above the speed of sound are reported as not creating a sonic boom.

Electromagnetic Effects

UFOs are occasionally reported deflecting magnetic compasses at considerable distances,interfering with radio reception, and causing distortion of TV pictures. In a number of cases, low-flying UFOs have been reported stopping conventional automobile engines but not diesel engines. Pursuing aircraft have reported the entire aircraft becoming overheated in a very short period of time.

Radar

UFOs are sometimes tracked by radar. In many cases, the radar blip is not "solid" but ghost-like, fading. Radar "angels" are a phenomenon often attributed to temperature inversions which may be returns from UFOs.

Landings

In one class of sightings, "landed" UFOs are really hovering just above the ground. In many cases imprints of one or more "feet" are left on the ground. In grassy areas landed UFOs commonly flatten the grass in a circular pattern like a nest, as would be caused by a spinning object when it touched down.

Unless we assume (as some like to do) that thousands of people all over the world are joined in a conspiracy to describe non-existent objects or are suffering from some recurring form of mass hypnosis, we are left with one, and only one, eminently logical hypothesis. This is no casual supposition, to be passed over lightly. This preliminary hypotheses is a cornerstone of the scientific theory which we shall construct throughout this book. We shall state it as follows:

FIRST HYPOTHESIS

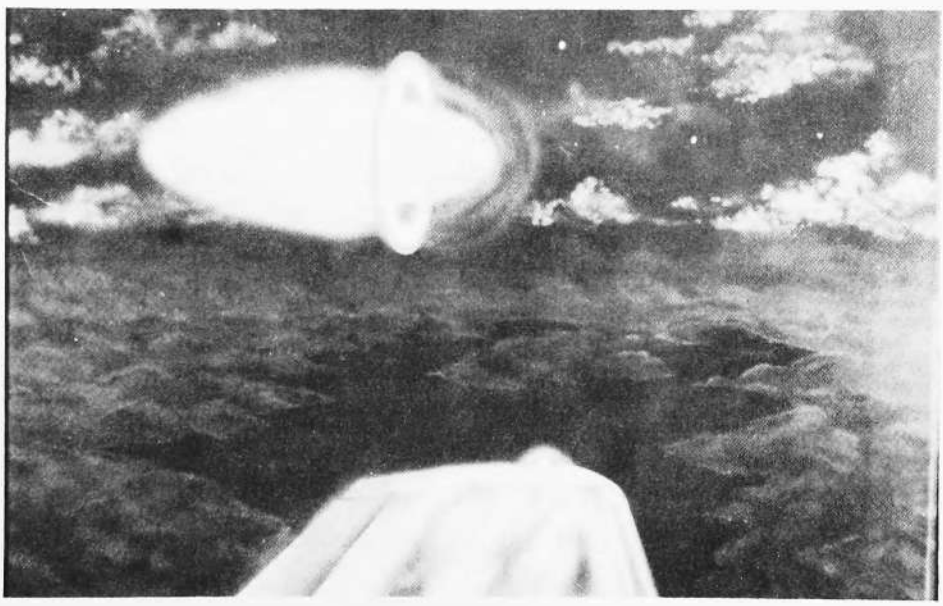
The volume and consistency of UFO reports and particularly the close encounter observations are evidence of unique but real physical objects in our three-dimensional world.

This seems like a simple enough statement but it is extremely important for everything which follows. It means that we assume we are not dealing with lies, hypnosis, space warps, or goblins, but with real objects which obey the laws of physics as we know them. It means that the scientific method can be applied to the problem of determining how these devices work. That is the purpose of this book.

SUMMARY

It is interesting to note that the question of what UFOs are, and where they come from, engenders such hot debate so as to preclude any scientific investigation to date and yet the same questions did not prevent the investigation of the electron, proton, and neutron. The answer lies in the sensitive nature of "what are they?" and "where are they from?" - questions which relate to man's present-day concept of himself in the universe. This will be explored in more detail in the next chapter.

In this chapter we have discussed the statistics of UFO reports along with the consistency of the reported observations and conclude that in spite of the uncertainties, there is a kernel of reports representing real physical objects which cannot be explained, either as natural phenomena or man-made objects. As a result, we conclude that these objects can be studied using the scientific method, in spite of the many uncertainties in the UFO report data.



Painting by Al Reed, Fremont, California, of object observed by pilot over San Luis, California Reservoir, August 8, 1981 from 1980 Piper Archer II aircraft (Courtesy of Mutual UFO Network, Inc., - MUFON).

2. ANGELS ON HIGH

Assuming that the true UFOs are real physical objects and not natural phenomena or man-made devices, the logical conclusion is that they are objects from another world or worlds. As mentioned previously, this hypothesis arouses strong emotions dealing as it does with man's own image of himself in the universe. This is mildly surprising considering that the concept of extraterrestrial life has been around for many years in the science fiction literature.

ON THE POSSIBILITY OF EXTRATERRESTRIAL LIFE

The idea of life, other than that on our own planet, has been strengthened considerably in recent years by a number of experiments and observations in a new interdisciplinary field called Exobiology. The pioneering experiment in this area was performed by Harold Urey, Stanley Fox, and Stanley Miller. They simulated the supposed primordial conditions on the earth, using only simple inorganic compounds such as carbon dioxide and water, high pressure and electrical discharges to simulate lightning. After a time, the contents of this primordial pot were chemically analyzed and found to contain traces of the basic amino acids, the most fundamental building blocks on which all living organisms that we know are based. The implication of this experiment is that life forms may spontaneously evolve as soon as certain common conditions occur early in the life of a planet.

More recently, radio telescope observations of gas clouds in interstellar space have turned up a variety of common molecules which heretofore were only thought to form on planets. This raises the possibility that the chemical building blocks of life may even begin to form in the void of space and "rain down" continuously onto the planets. Secondly, observations of spin rates for many stars indicate that a significant fraction have planetary systems, although no direct observations of other planetary systems have yet been made. The number of probable planetary systems in combination with the evidence that life may evolve spontaneously under the right conditions of pressure and temperature leads to the conclusion that there may be many living worlds even in our tiny neighborhood within the Milky Way galaxy.

Moreover, we must assume that the earth is no more unique in time than in space. That is, because of the large variability in the time of birth of stars, many planetary systems are behind ours in their development but many are also ahead of ours. The possible magnitude of this time difference leads to the most staggering conjecture of all; that is, when we attempt to imagine a civilization, say, 1000, 10,000, or perhaps 100,000 years ahead of our own. Our entire technology, which we think of as being so sophisticated, has evolved only in the last 200 years or so. This development is studded with "spectaculars" which were not imagined even as recently as ten or twenty years prior to their occurrence. For example, the isolation and elimination of major diseases such as polio, the internal combustion engine, powered flight, the atomic and hydrogen bombs, the laser, the computer, the Apollo moon landings, etc. Such advances will continue apace, making it impossible to guess what our own technology will be like even fifty years from now. What could we possibly comprehend about a really advanced technology, say, 10,000 years ahead of our own. Given our fledgling trips to the moon at (technological) age 200, it is entirely reasonable to imagine a 10,000-year old technology

capable of routine flights between stars in a small neighborhood of the galaxy.

Based on these arguments, and perhaps a bit whimsically recalling the biblical quote from John 14:2, "In my Father's house are many mansions (*or abiding places*)...", we can state our second hypothesis:

THE SECOND HYPOTHESIS

> The hard core of observed UFOs is consistent with the concept of highly developed extraterrestrial life outside our solar system, and is therefore assumed to be spaceships from such civilizations located in the nearby portion of the galaxy.

In his epilogue, Dr. Hynek [Hynek 72] suggests that the extraterrestrial hypothesis may involve phenomena beyond physical science as we know it, and therefore should be avoided by any scientist desiring to maintain his credibility among his peers. This attitude is apparently based on certain reports of UFO behavior which seem unexplainable. However, it is an important premise of our investigation that they *do* operate within the physical laws, and indeed, as we follow the thread of reason through the data, a rational explanation and moreover a fascinating design for a spacecraft evolves.

Many contemporary scientists have come to believe that life probably exists in numerous other solar systems. For example, Carl Sagan and I. S. Shklovsky [Sagan 68] suggest a number of interesting possibilities relative to extraterrestrial intelligence in their book, *Intelligent Life in the Universe.* This is also a strong theme in Dr. Sagan's television series, *Cosmos.* However, as fascinated as he is with the possibility of extraterrestrial intelligence, he does not believe that UFOs at our very doorstep are manifestations of that intelligence. His reason is simple. We have no tangible evidence, e.g. a crashed UFO or an artifact, that can be proven to have come from another

world. When queried about UFOs, his well-known response on this subject is, "Extraordinary claims require extraordinary proof". Establishment scientists just cannot believe that advanced beings could keep us from obtaining an artifact over the decades during which the UFO sightings have occurred. Actually, there are one or two cases in which, say, metallic pieces were supposedly obtained from the explosion of a UFO but it was impossible to *prove* that they were not of earthly origin.

SEEDING OF THE PLANET EARTH

This discussion leads directly to an even more controversial hypothesis. Because of the great difference that would naturally be expected in the time of birth of stars and their consequent planetary systems, even among those in the same neighborhood within a galaxy, the odds are extremely high that one civilization would develop, evolve, and propagate itself throughout the neighborhood before any other civilization developed independently. The desire to conquer new frontiers is inherent in the nature of man, as witnessed by our own history. It is certainly conceivable that within the next 100 years we will develop the technology to send men to the nearer planets and within 1000 years to the nearer stars, assuming of course that we do not destroy our civilization by a nuclear holocaust in the interim. If, in our travels, we find a beautiful planet, full of life, but with only primitive creatures such as ape men, it is most likely that we would colonize the planet ourselves, rather than wait, say, 100 million years to see if a mutation occurs which produces an intelligent species of man. However, our controversial hypothesis precludes this possibility since it implies that *we ourselves are possibly the product of such a colonization.*

The story of Adam and Eve is most easily understood as a description of the "seeding" of the earth by "gods" from space. Notice the plurals in the following quote from Genesis 1:26.

"Then God said, 'Let Us make man in Our image, according to Our likeness...'." Subsequent stories such as the tower of Babel, the destruction of Sodom and Gomorrah, Noah's arc, and the arc of the covenant could be descriptions of attempts to "steer" the propagation of this seeded race in the desired direction. If this were the case, then the biblical genealogy from Adam to Jesus Christ may indeed give an accurate measure of the span of intelligent man on this earth, and skeletons of primitive forms, over which the archaeologists argue, would be just dead ends of evolutionary paths with no direct connection to modern man. Thus, the popular argument between Creationism and Evolution would be resolved in favor of the former but with a twist which undoubtedly will make it a hard pill for the avid creationists to swallow.

Dr. Sagan does not consider that the earth was seeded by an extraterrestrial intelligence. His primary argument lies in the fact that all life forms on the earth are based on the same chemistry, the identical amino acids. This indicates, according to him, that all creatures on the earth, including man, evolved from the same primordial matter. He feels that there are probably other chemistries on which life forms might be based. Therefore, he reasons, a seeded race would probably not have the same chemical basis as the more primitive life forms on the planet.

There is a fundamental weakness in this argument. There is no evidence that life can be based on any other chemistry, and given our superficial understanding of what separates living and non-living matter, this claim to the contrary is not acceptable. Using Dr. Sagan's very words, "Extraordinary claims require extraordinary proof". Another more fundamental argument can be developed from the biblical statement, "God formed man of dust from the ground". One interpretation of this is that the seeded man was created using an extension of the DNA on which the other more primitive earth creatures are based. Considering that scientists are already delving into

genetic engineering, this does not seem too tall an order for a more advanced technology. The assumption of a single chemical basis for all life does not preclude the existence of higher forms based on more complex genes. Nor does it preclude the genetic engineering of these higher forms by a highly advanced technology.

When considered in this context it becomes much easier to accept the biblical events literally as they are written. They may be more accurate than any of us ever imagined. For instance, the so-called wheel of Ezekiel has been interpreted as a (close) encounter with a UFO or spacecraft [Blumrich 74] described in the only terms that were then available. Although this reasoning may legitimize the Bible to many, it would certainly be condemned by many churches because it replaces the ethereal concept of the angels by a much more physical one.

PROS AND CONS

If we accept the notion that the earth is being regularly visited by extraterrestrial beings (based on UFO reports), it becomes rather academic as to how many years their technology might be ahead of our own. If we accept the notions that these creatures seeded the earth along the lines mentioned above, they must have been capable of space travel, say, five thousand years ago. Also the technology gap widens profoundly if we accept the hypothesis that these beings are not from other planets in our solar system. At least our fledgling probes of the nearby planets seem to indicate that these are not suitable in their present states to support life. Their ability to travel between stars is an awesome indication of how advanced these "lords and angels" might be.

Considering this tremendous technological gap, it is not difficult to understand how these beings have prevented our capturing a UFO or obtaining an associated artifact which can be proven to be from another world. Yet this remains one of

the primary reasons why many men of science do not believe in the extraterrestrial origins of UFOs. They believe visitors would certainly come and pay homage to us. But realistically speaking our best scientists and politicians must be as the alchemists and witch doctors to these technological giants from space.

Another objection often raised to the extraterrestrial hypothesis is the long time that would be required for an interstellar voyage. Let us assume a star ship leaves a planet in the system of Barnards star, which is the closest star to our sun - some 6 light years away. If this ship travels to earth, performs some assigned tests, and returns to its home planet, the trip as measured on that planet cannot take less time than 12 years. This is the time which is required for light to make the same trip. This is an absolute limit postulated by Albert Einstein, constituting the very cornerstone of his Special Relativity theory which is universally accepted. In actuality it would take longer than this because the ship cannot accelerate and decelerate instantaneously and can never actually reach the speed of light. Most of us would consider the resulting transit time too long to wait for the return of a probe, and certainly too much to expect from any crew to take a trip which would occupy a large fraction of their life span. But who are we to say what is likely or not in such an advanced world. Perhaps the average life span is 500 years. Perhaps the process of exploration and monitoring of distant planets progresses independent of the lengths of trips even if they do span the better part of a lifetime. Perhaps states of suspended animation can be induced during long trips.

Although the speed of light constitutes an absolute limit which determines the minimum round trip time as measured on the home planet or the earth, the same theory of Special Relativity provides quite a surprising paradox with respect to time as experienced by the travelers themselves. If the vehicle accelerates and decelerates relatively quickly so that most of

the voyage is made at constant speeds approaching that of light, this theory provides a simple equation which relates the times in the two frames of reference. It not only shows that the travelers will age less than their counterparts back on the home planet, but also makes it possible to calculate the time difference. This is a real effect, i.e. clocks on board the starship will read less than clocks that remained home, but they can be directly compared only at the conclusion of the trip.

Suppose a traveller leaves Barnards star headed for earth. He accelerates and decelerates quickly at the terminal points and the stay is a short one. As a result the periods of acceleration have a negligible effect on the transit time. If the spaceship makes the round trip at $0.8c$, the elapsed time measured on earth will be given by:

$$\Delta t = \frac{l}{v} = 15 \text{ years}$$

Thus persons on earth age 15 years during this time. However, Special Relativity gives the time measured on the ship by:

$$\Delta t' = \frac{l}{v}\left(1 - \frac{v^2}{c^2}\right)^{\frac{1}{2}} = 9 \text{ years} \qquad (1)$$

where c is the velocity of light and v is the velocity of the spaceship as measured on the earth, and l is the distance between the earth and the star.

This simplistic treatment belies the more profound theory of General Relativity required to cover the periods of acceleration, which in actual space flights may not be negligible.

From our earthly point of view, such a time saving for the traveler would probably be an inducement to take long voyages that we otherwise might feel occupied too large a fraction of our lifetime. It would appeal to more socially independent types who did not have strong family or marital ties. It would provide a fascinating way of stretching our lives into the future

once back on our home planet. However it is meaningless to apply our concepts and reasoning to a civilization so much more advanced than ours.

At the present state of our technology these examples are of academic interest only, since it is virtually impossible to conceive of a rocket (our means of space travel) which could reach such velocities while carrying sufficient fuel to slow down and stop at the end of the voyage. However, as we develop our theory further, we shall see that there may be other ways to travel in space, i.e. with ships that may be capable of such speeds. The promise of this time saving should spur us on to develop these more advanced technologies so that we too can travel to other solar systems and hopefully visit other civilizations.

As discussed in Dr. Sagan's book, consequent advances in philosophy, politics and government must also exist in order to have prevented the self-destruction of technologically advanced civilizations. As difficult as it is to comprehend their technology, how much more difficult would it be to understand the values, institutions and thought processes of such an advanced civilization. If we could anticipate the motivations and principles of an advanced society, we would be much closer to its realization, although there would still be a gap between knowledge and implementation. When we try to understand why the intelligence behind the UFOs does not attempt to make direct political or scientific contact with us we run up against this very problem.

Nonetheless, even in our simple minds we can conceive of several possible reasons why UFO crews have refrained from formal contact with us. First, if our society has been periodically monitored for centuries, there would be very little reason for direct contact in recent years. Having a knowledge of our history, it would be quite easy to monitor the modern world via radio and television, with which we literally flood the airways. After all, this is the way we, the inhabitants, learn of

the events which constitute our world. Also, an advanced society might be much more cautious about interfering in the politics of another system. The difficulty of such intrusions, the unpredictability of the results, is eminently illustrated by the powerful United States of America in Vietnam. Perhaps someday we will learn not to act in this way, and most likely those of a more advanced society have long since learned this.

Thirdly, there is absolutely nothing that beings of an advanced society, such as those hypothesized, could learn from us. Even our very best scientists and mathematicians would seem like witch doctors, so that even with a perfect understanding of our language they could not learn one useful scientific fact. Added to this is the fact that we, the natives, are truly dangerous and our actions toward an alien being would be unpredictable to say the least.

Lastly, it is possible that spaceships from other civilizations stop on the earth merely because it is a beautiful and bountiful planet, an oasis in the vastness of space, rather than because of any intensive interest in the primitive inhabitants. Since the nearest star is approximately six light years away, the crew of a spaceship traveling from that star to another more advanced civilization beyond our own would certainly enjoy stretching their legs upon reaching the earth.

CONTACT?

Many people believe that UFOs are slowly and systematically allowing their craft to be observed more and more frequently as a prelude to their making some formal contact. Such a "softening-up" process would tend to prevent panic at the time of such contact. This has already worked to a degree. The public interest in UFOs has declined each year despite the continuing reports because the mystery has remained unsolved for so long. We are a people who like a quick resolution of questions and if none is forthcoming, interest wanes. Also, we have

experienced this contact more than once via fiction tending to take the "edge" off the true story.

When and if such contact takes place we will of course want to know about the other worlds, their religion, technology and society but perhaps the most fascinating things they might have to tell us will be about our own earth - about the mysteries of our past: How does a planet form? Does life develop spontaneously? What caused the magnetic field reversals recorded in the rock layers of our earth? Do the poles of the earth shift suddenly and catastrophically? Is Velikofsky's theory of Venus correct? Was the Tunguska meteorite a spaceship destroyed because it was about to crash on the surface of the earth? Was the earth's atmosphere twice as dense in the time when the pteradactl flew the skies? Did the impact of a large comet cause the extinction of the dinosaur? These and a thousand more questions might be answered - questions that we earthlings have little hope of answering unequivocally.

Independently of UFO sightings, the scientific establishment is leaning toward a belief that extraterrestrial civilizations probably exist. As a result, several government-funded studies have been initiated in which large radiotelescopes are continuously "listening" for radio signals which might indicate their existence. These same scientists generally will not acknowledge that UFOs are worthy of study or that they might be manifestations of these civilizations at our very doorstep. It seems such a simple logical conclusion that it really takes a concerted effort to ignore it.

But enough of these digressions. Let us attack the part of the problem with which we can deal directly using our most powerful tool, the scientific method. By devising a theory of how UFOs fly and proposing unique observations and experiments, we may be able to prove the origin of UFOs even if we are not able to capture one. This is the purpose of our little book.

3. THE PHYSICAL THEORY

Having argued rhetorically in favor of the extraterrestrial origins of UFOs we now proceed to the most unique aspect of this book, the development of a complete theory of how the observed craft function, including lift, propulsion, stability, control, and power source. We require that each facet be consistent with the mass of UFO reports on the one hand and the laws of physics on the other.

FLIGHT MECHANISMS

Although our present technology is not greatly advanced, most of it having come about within the last century, we do assume that our comprehension of the principles of physics has reached the point where the major forces such as could be utilized in a flying machine are understood conceptually [Feinberg 67]. We therefore reject the nebulous concept of anti-gravity devices which are often bandied about in the popular literature since no such force has ever been documented. Such artificial constructs are both unpalatable and unnecessary. It is possible to conceive of flying machines other than those already invented, which are based upon known physical principles yet are not practical at the present state of our technology. Major breakthroughs in technology, such as the harnessing of the fusion reaction, should prompt a reevaluation of all the possible concepts by which forces and motion might be generated for flight.

Based on the observations of many people, who describe silent flight and hovering of UFOs for periods as long as an hour, we reject the two flight mechanisms which are the principles of all earth-invented heavier-than-air flying machines, i.e., aerodynamics and rocketry.

Aerodynamics

Aerodynamics utilizes the motion of airfoils through the air to generate lift. Obviously it is possible to build a hovering vehicle using this principle, but such a vehicle is restricted to very modest altitudes and velocities, and the motion of the surfaces must generate both noise and turbulent motion of the air around the vehicle - phenomena which are not observed in most UFO sightings [NICAP 64].

Aerodynamics utilizes the principle of conservation of momentum, producing lift by the continuous transfer of momentum to the surrounding air. This is most obvious in the case of helicopters hovering at low altitudes but the same principle applies also to fixed-wing aircraft. The hypothesis of the extraterrestrial origin of UFOs carries with it the corollary that the unidentified vehicles sighted in our atmosphere were probably not designed only for flight in the atmosphere. This would cause us to logically dismiss a vehicle based on aerodynamic principles. The shapes of vehicles reported by the majority of observers, i.e. the disc, could develop some lift when in motion, as does the toy disc known as the frisbee, but obviously do not depend on this for flight because this would not allow hovering. Also observations of unusual maneuvers performed by flying saucers described by pursuing pilots indicate that changes in direction are not accompanied by the normal attitude changes characteristic of aerodynamic vehicles. As mentioned, flying saucers are often reported hovering silently for minutes at a time causing no noticeable buffeting of trees or foliage immediately below them. This indicates that no transfer

of momentum to the surrounding body of air occurs. Based on the available evidence then, the disc type UFO is not aerodynamic in design.

Rocketry

Rocketry is also based on the concept of conservation of momentum. The rate at which mass, initially carried in the vehicle, is ejected in one direction determines the acceleration of the remaining portion of the vehicle in the opposite direction. Using this principle, which is independent of the presence of any atmosphere, man has been able to move into space, where the (aerodynamic) transfer of momentum to the atmosphere is impossible. However, the enormous mass which must be on board the Saturn vehicle at launch in order to put a three-man crew on the moon and return them, cannot help but make one wonder whether there might be another approach to the problem of space travel. Unfortunately, even the most "visionary" proposals for interstellar travel coming from the scientific establishment are tied to the out-dated concepts of rocketry or jet propulsion. A prime example of this lack of imagination is a proposal to build a giant rocket ship powered by successive explosions of H-bombs. We can certainly do better than this if we merely heed the many clues provided in the mass of UFO reports.

The very idea of a 20 or 30-foot disc of reasonable density hovering for an hour is impossible based on rocket technology, since the mass ejected downward for the duration of this period would have had to be on board the vehicle at the beginning of the period. In addition, the mass ejected into the atmosphere by a rocket could not help but generate turbulence and noise. Thus, the silence of the saucers and the apparent conservation of their mass, rules out rocketry, and implies a much more sophisticated technique which conserves potential energy.

THE PRINCIPLE OF MAGNETIC FIELD INTERACTIONS

Since these two basic flight techniques, both involving momentum transfer to gases cannot reasonably be ascribed to the flying discs, it remains for us to establish a new hypothesis as to the principles by which they fly. This hypothesis should be consistent with as many sightings as possible, at the same time being based on well established physical principles.

Because no transfer of momentum to the surrounding atmosphere or to exhaust gases appears to take place, we assume that the UFOs generate intense fields which interact with the ambient fields in space and near the earth to produce the forces required to counter gravity and maneuver.

We have two choices based on our present knowledge of physics, i.e. electric fields or magnetic fields. It is a well known fact that the earth possesses both electric [Sutton 61] and magnetic fields against which these vehicles could interact. Ideally speaking, the electric field interaction could produce a greater force because electric charge can exist in the form of a monopole. This means that the vehicle could build up a large positive charge without a corresponding negative charge tending to cancel it out. However, we rule out an electric field interaction based on the fact that the large accumulation of electric charge needed on the disc would ionize the air near the vehicle and result in lightning bolts between it and the earth or surrounding clouds, a phenomenon that has not been observed in connection with UFOs. In addition, such lightning would discharge the vehicle causing it to lose its lifting force and crash.

In spite of recent experiments designed to find magnetic monopoles, we must assume, based on all available evidence, that magnetic "charge" can exist only in the form of a dipole, i.e. a north and a south pole of equal strength in proximity to one another. The magnetic dipole field is completely stable, that is, the north and south poles do not come together and "discharge"

as would positive and negative electrical charges. Its apparent disadvantage is that the translational force generated by interaction of a magnetic dipole with an ambient magnetic field, which is the force proposed to counteract gravity and make the vehicle "fly", is relatively small. The reason can be understood if one pictures the magnetic field interaction as two separate interactions of the north and south poles with the ambient field slightly above and slightly below the vehicle. Since the forces generated will be of nearly equal magnitude and nearly opposite in direction, they will tend to cancel one another.

Based on this physical picture it is easy to see that the only translational force that can be developed is due to the spatial difference in the ambient field between the two poles, known as the field gradient. Generally these two offset forces will cause a torque on the dipole which depends on its attitude relative to the ambient field. This torque can be very strong and the proposed design must control it in order that the vehicle be stable. A method for accomplishing this is given later in this chapter.

Although the presence of this strong torque seems disadvantageous at first consideration, deeper reflection reveals that a means of generating torques is a necessary element for control of a magnetic interaction vehicle of the type proposed. Having two force centers enables control of the total force due to their orientation relative to the ambient field gradient. The torque, properly controlled, can provide the means to orient the vehicle so as to produce the desired net force which determines the motion of the vehicle. These concepts will become clearer as we continue through the chapter.

As a result of these factors, we select the magnetic field interaction as the most logical mechanism by which the UFOs fly, and will expand on these ideas in the following sections.

THE THIRD HYPOTHESIS

The flying discs suspend themselves and maneuver by interacting with the magnetic field of the earth, heavenly bodies, or the ambient field in deep space.

In the case of the earth, the ambient magnetic field arises from the circulation of currents in the interior of the earth, therefore the momentum transfer required for propulsion occurs between the vehicle and material carrying these currents, and does not involve the atmosphere or exhaust gases. Figure 3-1 illustrates the large-scale approximation of the geomagnetic field.

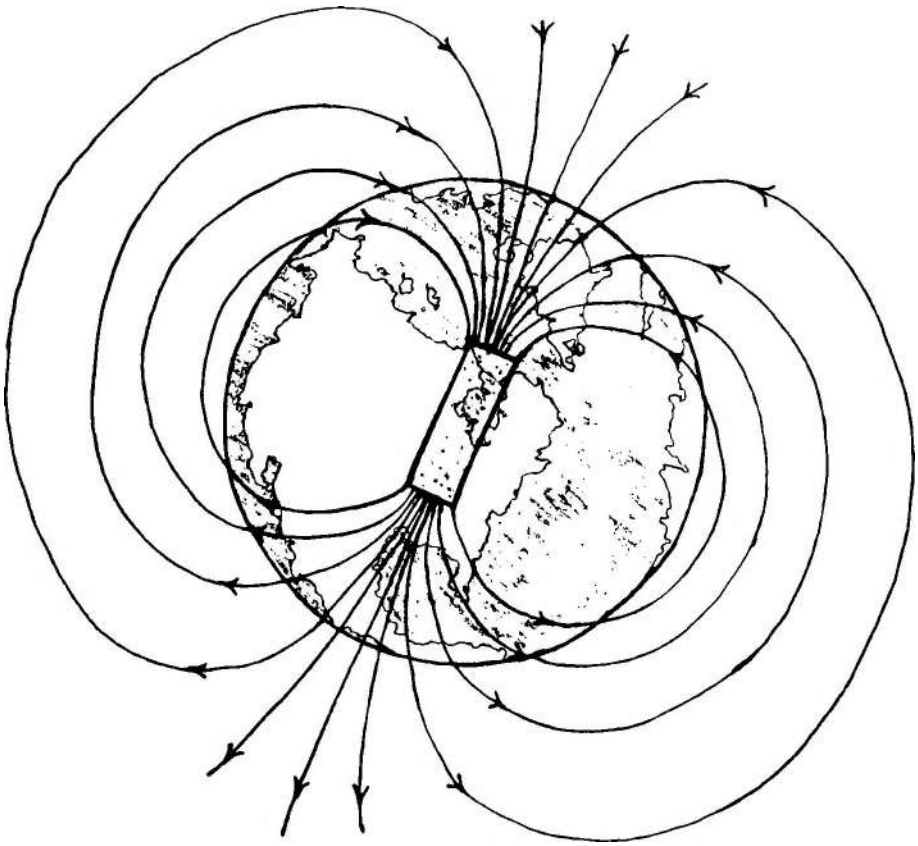


Figure 3-1: The magnetic field of the earth can be approximated by a large dipole

A simple analogy for the magnetic field interaction between the vehicle and, say, the earth, is the repulsion of one permanent magnet by another when they are oriented with similar poles in opposition. This has been experienced by the great majority of people in the developed world. Now picture one of the magnets becoming larger and larger until it is half the diameter of the earth and is imbedded in the earth between the poles, and the other magnet becoming a flying disc. It is this same repulsive force which opposes the gravitational attraction of the earth and allows the vehicle to "fly".

However, although the earth possesses a magnetic field of this type, it is relatively weak; therefore, in order to support its weight, the magnetic field generated by the flying disc must be extremely strong, stronger than can possibly be produced with our present technology.

The next question is how this enormous field is generated. It is certainly not from a big overgrown bar magnet, because the weight of such materials far exceeds the magnetic force on them due to the earth's field. Our experience in the physics laboratory and the multitude of reports on disc-shaped objects lead us to the conclusion that it is generated by a closed loop of electric current. Such a configuration generates a magnetic field very similar in shape to that of a short bar magnet, i.e. a dipole field (with two poles called North and South). The generation of magnetic fields by coils of wire carrying electric currents are very common, being the basis for all electric motors and generators. Indeed the circulation of electrons within atoms is a microscopic source of magnetic field.

We further assume that this current circulates in a superconducting medium and thereby maintains its strength indefinitely without requiring a continuous generation of electrical current. This is another analogy between the vehicle and the permanent magnet. Solid state superconducting materials have been studied for decades in the laboratory, and properly cooled superconducting coils have been demonstrated to carry

current continuously for more than a year without any measurable decrease. However, the magnitude of the superconduction current is quite limited by our present technology. An alternative to the solid state superconducting loop, a plasma confined in a torus is also discussed in the following section.

The force experienced by such a vehicle when interacting with the magnetic field of the earth can easily be calculated using a well known set of equations. Details of the equations are given in the next paragraph. Understanding the mathematics is not necessary. It is important to understand the physical properties which determine the forces on the hypothesized disc. These are as follows:

1. The magnitude of the current flowing in the superconducting loop
2. The area enclosed by the current loop
3. The rate of change of the ambient (earth or interplanetary) field as a function of distance in the vicinity of the disc.

The magnetic field set up by a current loop can be approximated by that of a magnetic dipole with a magnetic moment, m, equal to the product of the current and the area within the loop. The classical interaction of concern is the force on a magnetic dipole located in a non-homogeneous magnetic field, where the dipole field corresponds to the field of the vehicle and the non-homogeneous field is the earth's field, the interplanetary or interstellar field in which it must travel. The equations [Peck 53] are:

$$\begin{aligned} F_x &= m_x \frac{\partial H_x}{\partial x} + m_y \frac{\partial H_x}{\partial y} + m_z \frac{\partial H_x}{\partial z} \\ F_y &= m_x \frac{\partial H_y}{\partial x} + m_y \frac{\partial H_y}{\partial y} + m_z \frac{\partial H_y}{\partial z} \\ F_z &= m_x \frac{\partial H_z}{\partial x} + m_y \frac{\partial H_z}{\partial y} + m_z \frac{\partial H_z}{\partial z} \end{aligned} \tag{2}$$

Using the MKS system of units, m is equal to the current in the loop projected onto the plane of interest. The partial derivative terms represent the local rates of change of the field components along three orthogonal axes. In actuality, the earth's field is a dipole field just as the field of the hypothesized vehicles; however, the dimension of the former is so large that locally the gradients can be represented in the local coordinate system in which x is East-West, y is North-South, and z is Up-Down.

Note that the force on the magnetic vehicle is proportional, not to the magnitude, H, of the magnetic field in the vicinity but to the local rates of change of the field with distance, sometimes called the spatial derivatives of the field. These vary with location on the earth but can be estimated accurately enough for the purpose of developing our theory.

Flight Near the Earth

Since the horizontal north-south derivatives are of the same order of magnitude as the vertical derivatives, the utilization of the ambient field at any point in space for both lift and propulsion is rather complicated and not immediately obvious from Equation 2. Generally speaking, the field of the earth is inclined in the north-south direction. This follows immediately from the general dipole nature of the earth's field. This can be visualized using the bar magnet analogy. The direction to the magnetic field lines changes completely from the pole to the "equator" of the earth dipole. In order of hover and not translate, the disc would have to be oriented so as to have the net force vector, be exactly vertical, countering gravity but not propelling the vehicle sideways. Therefore, the general attitude for hovering (ignoring for the moment the anomalies in the field) would be a tilted one. If the disc axis is aligned vertically, a horizontal force would result from the horizontal derivative of the earth's field in the north-south direction. Thus, the disc, in

order to hover, must be tilted away from the direction of the earth's field to generate an opposing horizontal force component.

Up to several thousand feet above the surface, however, the global dipole field of the earth is considerably distorted by local and regional geomagnetic variations so that the actual magnetic field derivatives are quite variable. As a result, a moving disc will continually experience changes in the forces upon it causing variations in its altitude and also in its attitude as its control system endeavors to maintain the magnetic lift vector in opposition to the pull of gravity, while at the same time sustaining a nearly constant horizontal force component for propulsion.

Landing the proposed vehicle in an area where the local magnetic field is inclined would be quite difficult because the disc must be tilted. However, it is usually possible to find local geomagnetic anomalies caused by near-surface geological features that have associated with them zones in which the magnetic field is nearly vertical. By seeking out such locations the vehicles could find suitable spots at which they could land in a nearly horizontal attitude.

Taking a simplified case we can calculate roughly the strength of the current loop required to lift a given mass in the magnetic and gravitational field near the surface of the earth. Assuming for purposes of simplification that the terms dH_z/dx and m_z dominate and that z is in the direction of the local vertical as would be the case near the magnetic pole of the earth, then the magnetic force must just balance the weight.

Magnetic Force = Gravitational Force

$$m_z \frac{\partial H_z}{\partial z} = Mg \tag{3}$$

Expanding the expression for the magnetic moment we obtain:

$$\pi R^2 I \frac{\partial H_z}{\partial z} = Mg$$

Using the following values:

M(vehicle mass) = 1000 kg

g(acceleration of gravity) = 9.8

R(vehicle radius) = 5 meters

Magnetic field gradient = 10^{-11} webers/sq m/m

Solving for the current, I, we obtain:

$I = 1.25 \times 10^{13}$ amperes

The required current in the superconducting loop is enormous by our present day standards. This may have dissuaded other investigators from pursuing this path further, but this is a mistake. In the theory we deal primarily with concepts. As our technology develops the magnitudes will be increased, usually in a gradual way, but sometimes in quantum leaps. The theory may not indicate the exact steps whereby this can be accomplished, but it can, if proven correct, indicate the specific disciplines in which to expend our effort if we wish to develop our own capability in this area.

The Superconductor Revolution

An example of such a technological quantum leap is the truly amazing revolution in the physical sciences begun in 1986 and currently taking place. After little progress in the last 70 years discovering superconducting materials that would operate at more than 23 degrees Kelvin, a discovery of a new class of superconducting materials has triggered a rapid series of giant steps which have traversed the range from near absolute zero to 100 degrees Kelvin, confirmed by other laboratories and indications of additional gains to come in the near future.

IBM researchers have announced current densities of 10^5 amperes/cm^2. The materials are ceramics, and consequent fabrication techniques allow them to be formed in thin layers on special surfaces. Because thousands of scientists the world over are working on these new materials in a highly competitive yet cooperative spirit, developments are still being announced weekly, and it is not possible at this time to predict where it will end. However, it is safe to say that this discovery increases by several orders of magnitude the chances of the correctness of our theory and cuts the time which might have been estimated for attaining such a technology as advanced in this book prior to this discovery from 50 years to only a few years.

Solid State Superconducting Torus

Two possible implementations of the current loop are conceivable, a solid state superconductor and a plasma superconductor. The former is pictured as a hollow tube, up to a foot or more in diameter, extending around the periphery of the disc, carrying an enormous current which naturally distributes itself in a thin layer near the surface.

A hollow torus would provide for the circulation of a coolant such as liquid nitrogen inside the torus. This presupposes that all superconductors, like those presently known to earth scientists, require some degree of cooling. It has been a long-held dream of scientists to someday discover a material which is superconducting at room temperatures, but very little progress had been made in this direction until quite recently. Still the theory lags the experimental work and therefore does not provide any maximum temperature limit. The mechanism by which the magnitude of the superconductor current is limited is thought to be a quenching or extinguishing of the superconducting state by strong magnetic fields, more critically by magnetic fields associated with the superconducting current itself. This is known as self-quenching. This phenomenon limits

the amount of current that can flow in any superconductor. The amount of current which can be carried without quenching is a function of the type of superconductor but it is also a function of the physical arrangement of the conductors which constitute the circuit. When a current flows in a wire, it creates a magnetic field, the lines of which are circles surrounding the wire in the plane perpendicular to the wire. The magnetic field at the surface of the wire will be inversely proportional to the radius of the wire. If the wire is wrapped in the form of a coil, as is usually done in order to generate stronger macroscopic fields for, say, a motor or generator, the local magnetic field at the surface of any individual wire is even greater because of the additional fields from the adjacent wires.

The toroidal conductor suggested herein could alleviate this problem. The curvature at its surface is much less than a wire, and since it consists of only one loop, there is no influence from adjacent currents. In this configuration, the current would approximate a sheet and would automatically arrange itself in a minimum energy state as it circulates in the toroidal shell. Figure 3-2 illustrates such a conductor and a cross-section of the magnetic field resulting from the circulating current.

The toroidal configuration affords other advantages. Because of its topological form, it provides two dimensions in which electric current can circulate around the major and minor diameters. Using a combination of flow in these directions, different circulation modes could be set up and controlled by applying magnetic fields locally to the surface of the forms, rendering certain zones non-superconducting and thereby forcing the current along the desired trajectory. By this means, the effective attitude of the current loop in space could be accurately and quickly controlled without an actual change in the vehicle attitude.

To estimate the current density within the superconducting material, we assume it is isotropically (evenly) distributed within the wall of the torus. Assuming a torus with a 5 mm wall

thickness and a minor radius of 0.5 meter, the current density would be of the order of 10^{11} amperes/cm^2. This is still orders of magnitude greater than the latest values announced by IBM researchers. The limit will probably be improved upon in the near future by a better combination of elements and better methods of fabricating the materials once the important factors are isolated.

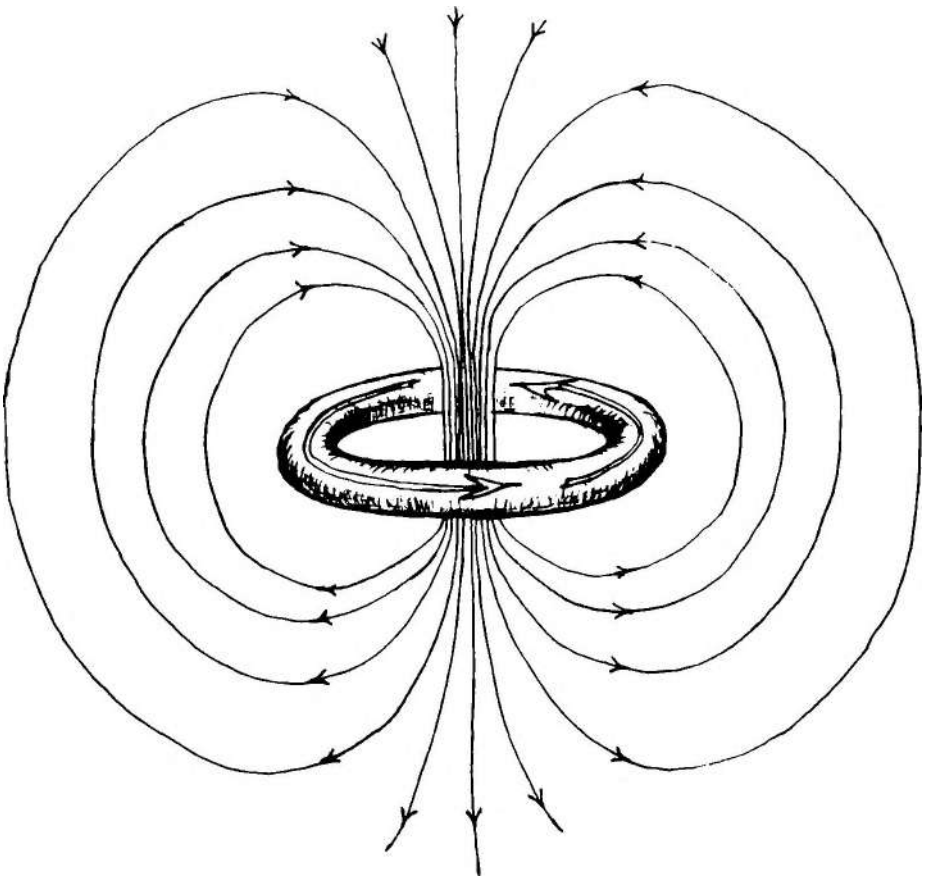


Figure 3-2: The current loop and cross-section of the resulting magnetic field

The solid state current loop is the more conventional approach but there is another, discussed in the next section, which

depends less on the maximum current limit, since it uses solid state superconducting magnets only for deflecting a circulating plasma into a circular path.

The Plasma Superconducting Loop - A New Concept

A second proposed method of implementing the main current loop involves a plasma as opposed to a solid state superconductor. In this concept, a plasma is contained within a hollow dielectric torus. The particles, however, are not in the random motion which characterizes high temperatures but are circulating at high velocities around the torus. Magnets made of solid state superconducting materials are arranged at intervals around the torus in order to deflect the charged particles in a near-circular path. This configuration is illustrated in Figure 3-3. The particle current is confined to the center of the torus, away from the walls, by the so-called *theta pinch* phenomenon. Assuming the torus has a radius of 0.5 meter, the resulting current density is approximately 2.5×10^9 amperes/cm^2.

As a result of years of research directed toward controlling the fusion (hydrogen bomb) reaction for peaceful uses, scientists have gained considerable knowledge about plasmas and their containment using magnetic fields. One such area involves the pinch effect mentioned above, which performs the very important function of preventing the plasma particles from impinging on the walls of the torus and dissipating all their energy. Although that research utilizes toroidal tubes also, there is a very important difference between what they are trying to do and what is suggested here for the magnetic field vehicle. In the fusion case, the entire purpose is to randomize the particle motions, i.e. to obtain the highest plasma temperature as possible so the positively charged particles will collide with one another and fuse. In this case, any mass motion of the particles around the torus is merely an undesirable circumstance. For

the flying disc we want to increase the systematic velocities around the torus, *minimizing* collisions so that the ring current does not dissipate itself. We do not desire high temperature (defined by high random velocities) but the analog of low temperatures, i.e. a highly ordered system in which positively charged particles circulate in one direction and negatively charged particles (electrons) in the other direction. At very high velocities the probability of collision is low. This gaseous superconducting state would be analogous to solid state superconductors with the particles of positive charge shielding the electrons from one another and vice versa. This is a new type of superconducting state proposed here seriously, perhaps for the first time.

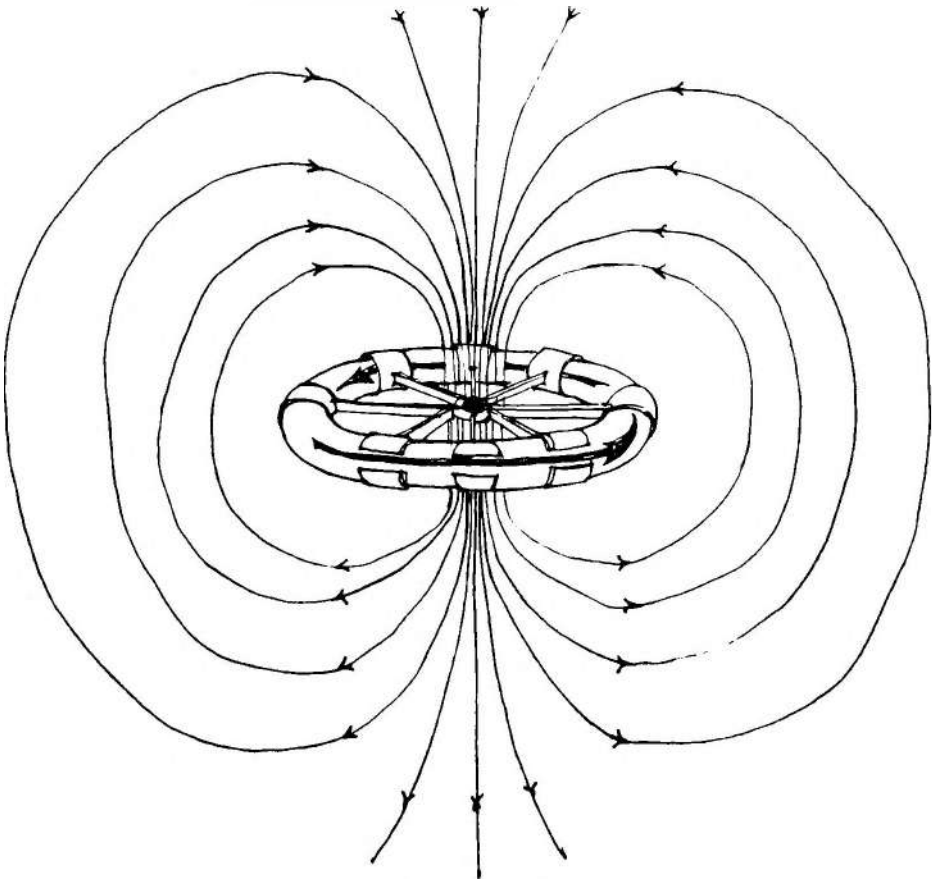


Figure 3-3: Plasma current loop concept

The following quotes, taken from the published literature on plasma research help support this concept:

> "In many situations a hot plasma behaves somewhat like a superconductor..." [post 56].

> "One such characteristic of an ionized gas is that the probability of collision between an electron and another particle falls off rapidly as the particle velocity increases. Thus an electron accelerated to a sufficiently high velocity will engage in practically no collisions and will continue to be accelerated by the field. Such electrons are said to have run away.... Under some conditions energetic electrons will travel around the stellerator (torus) long after the ohmic heating pulse is over, finally striking the walls only after the magnetic field falls off. During this time they travel several thousand miles, going around the stellerator tube about a million times." [Spitzer 58].

MAGNETIC FIELD GENERATION - SUMMARY

The hypothesized disc generates an intense magnetic field via an enormously strong electric current flowing in a superconducting loop which encloses the vehicle. Although this current is orders of magnitude greater than any created to date in our laboratories, we attribute this to the greatly advanced *technology* with which we are dealing, and not to any fault in the *concept* involved.

Two configurations are suggested, by which the main current loop could be implemented: a purely solid state toroidal shell and a plasma current contained in a dielectric toroidal shell with solid state superconducting deflection magnets at intervals around the circumference. Both designs produce approximately the same shaped field except that the latter may be fluted.

The flow of electrical charge around the periphery of the vehicle constitutes a closed electrical current which in turn produces a magnetic field resembling that of a dipole in the

space surrounding the vehicle. Externally, this field interacts with gradients in the magnetic field of the earth or interplanetary space to produce forces for propulsion. The external magnetic field may be bunched somewhat in the azimuthal direction due to the presence of the deflecting magnets.

Although the magnetic interaction can provide forces for suspension and propulsion, it is generally unstable, and an additional mechanism is required in order that the hypothesized vehicle be stable and controllable. The next section discusses the matter of control.

THE CONTROL SYSTEM

The motion of any rigid body is determined completely by the forces and torques (moments) acting upon it. The previous section discusses the primary forces, i.e. the magnetic field interaction and gravity. Torques are important because they determine the attitude of the vehicle, i.e. its orientation in three-dimensional space, and therefore are instrumental in its stability and control, just as in conventional aircraft. It is important to note that the lifting mechanism discussed in the previous section is, in and of itself, inherently unstable.

As an analogy, consider the conventional aircraft wing. It is the primary source of lift for the plane. However, by itself it is completely unstable. In order to use the lift that the wing supplies, it is necessary to add a fuselage with a tail empennage - a second smaller wing offset from the first far enough to allow it to create torques about the primary axis of the plane. Once a means is provided to control these torques we are well on the way to a practical, flyable vehicle. In the case of the airplane, of course, the example of how this might be accomplished was already present in nature. Men had observed birds for centuries, and flight was first accomplished more as an imitation of bird flight than as the application of science and mathematics to the problem.

The UFO design requires similar refinements in order that it be both stable and controllable. Although the observations of UFOs are not nearly as common as those of birds, we assume throughout this book that the volume of information from sighting reports is sufficient to demonstrate that these vehicles are stable and controllable and give some clues as to their method of stabilization.

Magnetic Interaction Torques

Before suggesting the means by which the primary lifting element might be stabilized, we need to understand the nature of instability. A torque on the vehicle occurs when the opposing forces on the two poles of the magnetic dipole are offset relative to the ambient field direction. This is illustrated in Figure 3-4. This torque is given by:

$$L = mh\sin\phi \qquad (4)$$

where L is torque, m is the magnetic moment of the current loop, h is the intensity of the ambient magnetic field, and ϕ is the angle between the axis of the loop and the ambient magnetic field vector.

This equation indicates that when the axis of the loop, the line from N to S in the figure, is exactly aligned with the local magnetic field the torque on the loop is zero because $\sin\phi = 0$. As the angle increases the torque increases to a maximum at $\phi = 90^0$ ($\sin\phi = 1$). However, the balance is unstable because the torque is in the same direction as the tilt, which increases the tilt even further, quickly turning the vehicle upside down. This changes the magnetic lift to a downward force causing the vehicle to crash. Returning to our analogy with hand-held permanent magnets, the small magnet being repulsed, unless perfectly balanced will flip over 180 degrees and immediately be

attracted to the larger magnet. It is this basic instability that must be counteracted in order for the UFO to be stable.

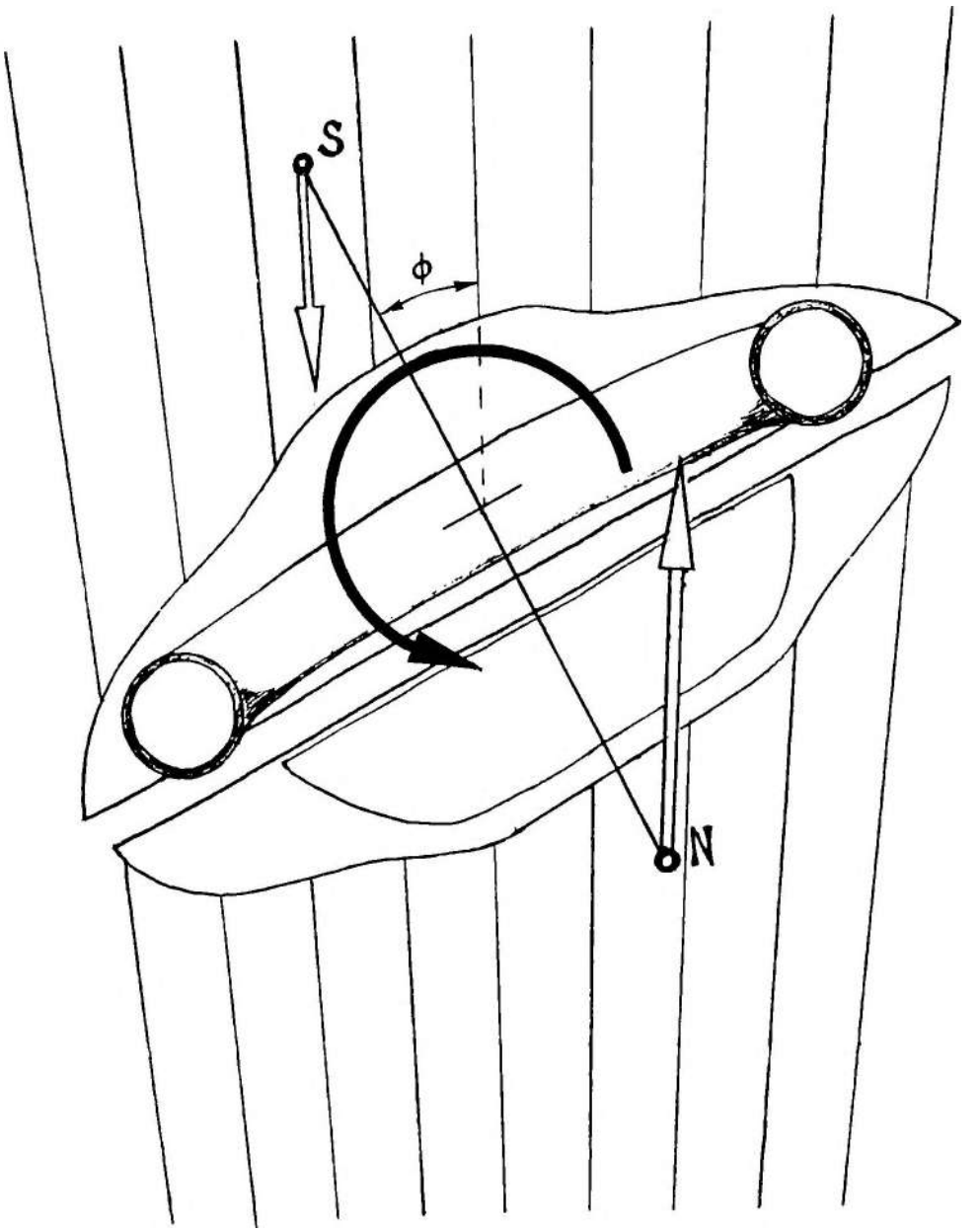


Figure 3-4: Forces on main loop dipole cause torque when vehicle axis is not aligned with ambient magnetic field

The proposed solution to this stability problem is twofold, involving an additional current loop working in conjunction with a gyroscopic element. The second current loop is oriented perpendicular to the primary loop. The secondary loop is oriented so as to generate a torque which cancels the torque due to the primary loop. This can be done with a smaller loop if the torque on the primary loop is minimized by keeping its axis nearly aligned with the ambient field, so that the value of sin ϕ is close to zero, whereas the control loop axis is oriented approximately perpendicular to the ambient field, giving it maximum torque for its size. The current in this control loop is controlled by a computer which acts as a servomechanism. A good analogy is the use of a digital computer servo to control the F-16 Fighting Falcon. Without the computer it is completely unstable, but with it the F-16 is the most maneuverable conventional jet fighter in the world.

The secondary loop performs two other functions. In combination with the main loop it generates translational forces on the vehicle for propulsion and it stabilizes the non-rotating portion of the disc against the tendency to spin in the direction opposite the gyro wheel, discussed in the next section, much like the small propeller on the tail of most helicopters. The current in the secondary loop is servoed to maintain the total torque close to zero but at the same time to create small torques when required for control of the vehicle. The control loop concept is illustrated in Figure 3-5. It can be rotated about the main vehicle axis to the desired direction, however using two control loops in quadrature would allow reorienting the control loop much more quickly.

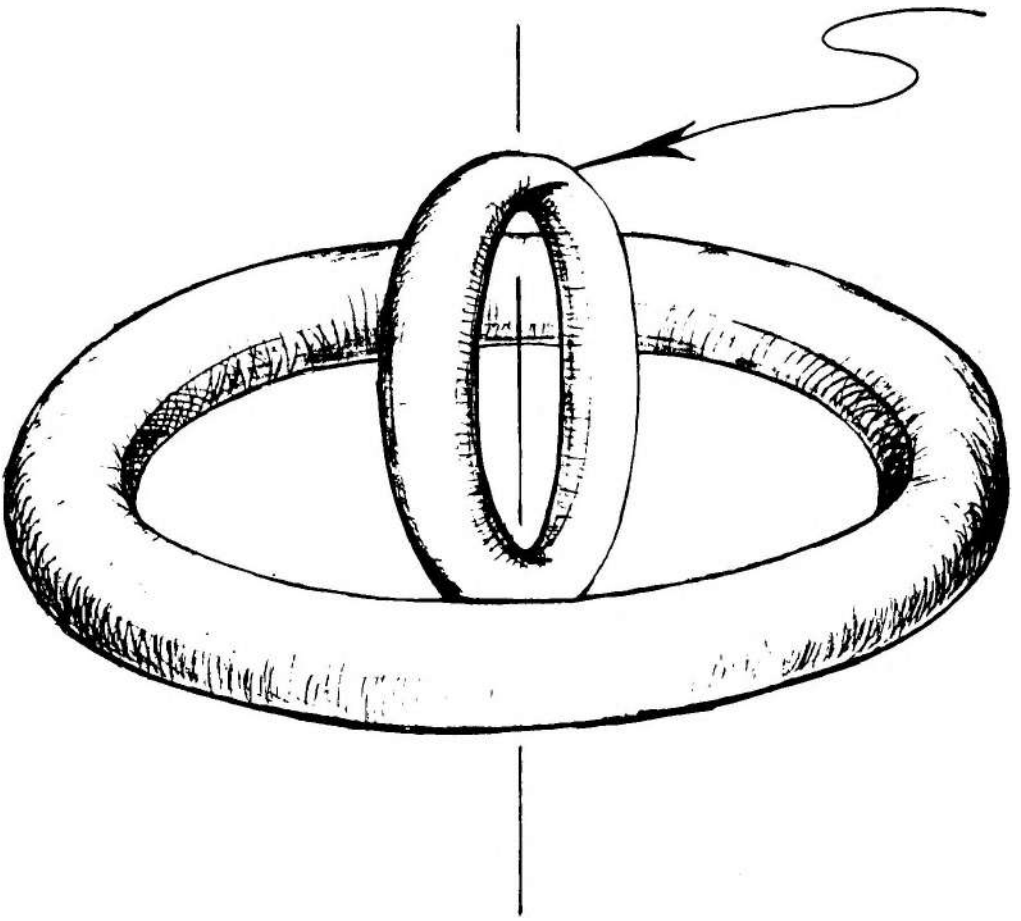


Figure 3-5: The control loop is a loop perpendicular to the main loop

Gyroscopic Torques

The secondary current loop reduces the enormous torque due to the magnetic field interaction of the main loop to controllable level. However, an additional mechanism is required to provide stability.

The second aspect of the stability/control system is suggested by many observations of UFOs in which parts of the vehicle have been observed spinning. Due to the symmetry of the disc it is easy to incorporate an annular section which rotates about the axis of symmetry.

Given the magnetic field configuration discussed previously this would be relatively simple to implement using the principle of the homopolar motor. By merely directing an electric current radially through the annular element it would rotate due to the intense magnetic field passing through it parallel to the primary axis of the vehicle. Because the spinning section rotates rigidly about the primary axis of the disc, the entire vehicle becomes a gyroscope. In the absence of any torques the vehicle will therefore maintain its attitude relative to the stars. If torques are exerted on the vehicle its reaction will depend upon the gyroscopic moment of the spinning element. Generally it will precess, i.e. the axis will rotate slowly like a top, about its center of gravity at a rate determined by the gyroscopic moment, which is a function of the rotational speed, the mass, and radius of the spinning element. In the proposed design the gyro works in conjunction with the secondary current loop described above, to orient the disc as required relative to the local magnetic field.

The Magnetic Helicopter

If we picture a second rotating element as containing the main superconducting current loop (of either type), then the net magnetic field produced by this element could be increased or decreased by changing the rate at which it rotates. By rotating it faster in the direction of the current flow, the magnetic field measured by a stationary observer nearby would increase and similarly would be decreased by slowing down the rotation. This could be used as a means of making changes in the magnetic lift on a vehicle without changing the actual superconduct-

ing current. Since the gyroscopic moment and the magnetic moment are linked in this configuration, the control system would have to maintain the proper relative rotation rates. If the same technique were used for the secondary current loop, the resulting design turns out to be operated primarily by mechanical means - increasing lift by speeding up the rotation of the main loop, changing orientation by controlling the speed and direction of the axis of the secondary loop. This could be considered a magnetic field helicopter.

This design is a very "mechanical" one, with electric motors of some sort controlling the rotation of both to give the desired lift and maneuvering capability.

CONTROL SYSTEM SUMMARY

The vehicle incorporates one or two secondary current loops which, when combined with the primary current loop, produce a complex magnetic field about the vehicle. The secondary coil is at right angles to the main loop. Instead of a single, rotatable, coil it would be possible to use two fixed coils arranged in quadrature to allow their action to be at any azimuth relative to the vehicle. The effective azimuth of the secondary current in the quadrature arrangement is controlled by the relative strength of the current in the two coils. In the case of a single secondary loop, it is oriented mechanically to the desired azimuth. The current flowing in the secondary current loop is controlled by a closed loop system to:

1. Cancel out the bulk of the torque on the primary loop which if uncompensated represents the major instability in the system.
2. Provide, by small deviations in this compensation, torques required to change the attitude of the craft.

The second facet of the control system is a large gyroscopic element, i.e., an annular segment of the disc which provides stability and interacts with the controlled torques produced by

the secondary current loops to produce the actual vehicle attitude changes.

The combination of controllable torques and a controllable gyroscopic moment results in a complex control scheme. A typical control sequence is pictured as follows:

- The vehicle is moving at a given speed and direction determined by the orientation of its current loops relative to the ambient field gradients. This attitude is maintained by gyroscopic element spinning at high speed.
- The gyro is slowed and a torque is generated by the pilot's action introducing an error signal in the secondary current loop servo.
- The vehicle precesses due to the action of the torque and gyro combined.
- As the vehicle approaches the desired attitude, the gyro speed is increased to stabilize the vehicle in the new attitude.
- The new attitude results in different forces on the vehicle and thereby a change in course.

In summary we state our fourth hypothesis as follows:

THE FOURTH HYPOTHESIS

> The flying discs are stabilized and controlled by a combination of magnetic (quadrapole) field and gyroscopic torques which are generated, respectively, by a secondary current loop perpendicular to the primary one, and an annular section of the vehicle which spins about the primary axis of the disc.

This combination of multiple controllable current loops generating torques combined with a variable speed gyro wheel can be mathematically modeled by computer programs in order to study the details of the process.

THE POWER SOURCE

Nowhere is the uniqueness of this new flight concept more pointed than in a discussion of the power source. The rocket, or mass reaction engine which we presently use for propulsion in space is a simple device to say the least. The faster mass can be ejected from the vehicle, the faster the (remaining) vehicle must go in the opposite direction. If mass is to be continually ejected from the vehicle, it follows that it must be on board the vehicle at the beginning of a flight. As the proposed journeys become more ambitious, the mass of the vehicle at takeoff becomes greater. Witness the Apollo moon flights which required a 30-story high launch vehicle. Obviously this technology has reached a practical limit. To travel further into space we cannot merely extrapolate the size and mass of the launch vehicle, we will need a completely new technology.

To understand to what extent the scientific community is limited by the past, a really "advanced" concept was aired on TV which consisted of a rocket vehicle whose "firing" consisted of the explosion of actual hydrogen bombs in sequence. This is not a forward-looking concept regardless of whose name is associated with the idea, but is a good example of how completely the rocket concept has become ingrained in our thinking when it comes to space travel.

The propulsion system proposed herein does not utilize rocket technology. Therefore the fuel for a flight or mission need not constitute a large mass. It only needs to contain a large amount of energy which can be efficiently extracted when needed to power what is essentially an electromagnetic engine. The mass of the fuel can be small, relative to the mass of the payload. This has profound implications for future space travel. Picture a disc weighing only as much as an automobile, able to travel from the earth to the moon and return on one tank of fuel. Part of the reason is the conservational nature of a magnetic field interaction and the superconductor phenomenon; a

second aspect is the tremendous amount of energy which can be contained safely in a small mass of fuel; and a third is a design which can extract the energy safely and efficiently without requiring a heavy and complex "engine". Our fifth hypothesis deals with the power source in our proposed flying disc.

Regardless of how perfect the conductivity of the superconducting loops in the vehicle discussed above, the current will deteriorate as the propulsion system is required to do actual work, for example moving upward in opposition to gravity. As this occurs, a mechanism must exist by which an energy source can replenish this current. This leads to our next hypothesis.

THE FIFTH HYPOTHESIS

> The UFO is powered by a controlled fusion reaction, operating in a transient (pulsed) mode. These pulsations "pump up" the current in the superconducting loops, thereby maintaining them against losses due to work done in flight.

The Fusion Reaction

A nuclear power source utilizing the controlled fusion of light nuclei is a logical choice for an advanced space vehicle of the type hypothesized. It is essentially the hydrogen bomb reaction under control. This reaction is a very efficient source of energy per unit mass of fuel; i.e. it would allow the carrying of an enormous amount of stored energy with only a small weight penalty. One fuel for such a reaction, deuterium, or heavy hydrogen, is known to be abundant; here on earth it constitutes one part in 6000 of all hydrogen atoms. Some 60 to 70 percent of the total energy output of the fusion reaction, (deuterium-deuterium) is predicted to be in the form of kinetic energy of changed particles. This is exactly the form in which it is required in order to obtain a direct electrical output.

The fuel for the reaction can be deuterium or tritium. The most promising reactions are listed below:

$$D + D = He^3 + n + 3.25 \text{ Mev}$$

$$D + D = T + p + 4 \text{ Mev} \qquad (5)$$

$$T + D = He^4 + n + 17.6 \text{ Mev}$$

Deuterium and tritium are isotopes of hydrogen. The former occurs naturally, whereas the latter is only formed by a nuclear reaction, i.e. the second reaction above. The waters of the earth contain an almost unlimited supply of deuterium fuel, enough to serve mankind for a billion years at 1000 times our present rate of power consumption. [post 56]

> "...Complete burning of the deuterons and their products, tritium and helium 3, in a thermonuclear cycle would produce about seven Mev per deuteron burned. This corresponds to 43 million kilowatt-hours per pound of fuel. By comparison gasoline, one of the best chemical fuels, yields about 6 kilowatt-hours per pound. Although only a small fraction of the hydrogen in natural water is deuterium, still the deuterium in one gallon of ordinary water has an energy content equivalent to 350 gallons of gasoline...."

These comments on the controlled fusion reaction may seem presumptuous, since no scientists on earth have yet harnessed this process; however, it has been the source of a great deal of work for several decades in many laboratories around the world and much has been learned. Success in harnessing this energy source is expected within a few decades. It is altogether reasonable to assume that vehicles of a technology which may well be hundreds or thousands of years in advance of our own would certainly have perfected this power source long ago.

At present scientists are studying two basic techniques for harnessing the power from the fusion reaction. They can be classed as steady state and transient. Although the transient

methods are more closely related to the hypothesized UFO power source, it is of interest to discuss some aspects of the steady state methods.

In order that the light nuclei react, they must come together. But since they are positively charged, they tend to repel one another and avoid contact. The steady state approach is to increase the "temperature" of the plasma (the "gas" made up of these light nuclei and free electrons) to about 100 million degrees, thereby giving these particles such high speeds that they will collide in spite of their mutual repulsion. Because these particles are electrically charged (completely ionized, i.e. electrons and nuclei completely separated from one another due to the violence of the collisions continually taking place) they can be contained in space by very intense magnetic fields generated by coils outside the evacuated container. This must be done because if the high energy particles are permitted to strike the walls of the vessel they will "knock off" impurity atoms which will hopelessly contaminate the plasma. Reactors of this type, the most popular of which are called TOKAMACs, are designed to produce electrical energy by a largely unimaginative scheme. They would be tuned to produce neutrons which, being electrically neutral, would exit the magnetic confinement fields and strike an energy absorbing blanket causing heat which would in turn create steam, turn turbines, turn generators, etc. A small amount of new fuel would be introduced either continuously or periodically, but the energy output would be essentially steady state.

The second approach is of more immediate interest for our hypothesized power source. It involves the instantaneous heating of a concentrated fuel pellet containing deuterium to very high temperature and pressure using powerful converging beams of laser light, electrons, or ions. The problem of containment is solved by creating the conditions required for ignition so quickly that there is no time for the escape of particles

or energy. This technique gives highly transient bursts of energy, a feature required for our proposed UFO power plant.

The following quotation indicates one researcher's opinion as to which of the basic design philosophies may eventually prove superior. [Post 57]

> "...In summary, a controlled fusion reactor must operate far from radiative equilibrium, under which condition radiation losses are limited to ordinary bremstrahlung. At a sufficiently high operating temperature reaction power will exceed radiation, permitting the achieving of a self-sustaining fusion reaction if no other significant losses are present. At the same time, to overcome excessive losses of particles (and thus energy) by direct transport out of the reaction region, either a high density (and therefore highly transient) mode of operation must be contemplated or containment for useful lengths of time by some type of electromagnetic field must be sought...."

Our UFO hypothesis suggests a highly transient mode of operation but for reasons not completely anticipated to date, i.e. because it facilitates the transfer of electrical energy from the reaction to the superconducting loop. It should also be pointed out that the pulsed scheme hypothesized here allows a much greater dynamic range of output power than a steady state system could produce.

There is one other important difference between the fusion devices being researched and the one required for our UFO engine. That is, we utilize the energy produced in the form of fast moving charged particles as opposed to neutrons. The deuterium-deuterium reaction produces more electromagnetic output than the deuterium-tritium reaction. In the transient method the bursts of charged particles exit the "furnace" at high speeds. How we propose to use these bursts of charged particles is explained in the following section.

The Engine

The proposed electromagnetic engine design is novel, but is based on the well established theory of electromagnetic induction, also known as Faraday induction. It is illustrated in Figure 3-6. Note that all the magnetic field lines, due to the enormous current flowing in the main loop, pass through the interior of the disc so that a very intense magnetic field is present in this area. It is at this position that the combustion chamber is located. It would be possible to shape the field at this position into a "magnetic bottle" which would contain a hot plasma. However, our engine must operate in the highly transient mode; therefore plasma containment is not of prime importance. The important aspect of the intense interior magnetic field hinges on its ability to extract electrical energy from the fast moving charged particles which are produced when each fuel pellet is ignited. The mechanism by which the energy from the plasma reaction is transferred to the main current ring is based on Faraday's Law of Induction and the Lenz Law. These state that when an outside mechanism causes a magnetic flux change within a current loop, an electromotive force (a force causing the acceleration of electrons in the loop) is generated around the current loop which is proportional to the rate of change of the magnetic flux passing through the loop. Actually the principle is used in the simplest electric motors and generators which we have here on earth.

In order to explain the differences between conventional and proposed usage, one must realize that the paths of charged particles produced in the fusion reaction are determined by the fields in their vicinity, and not by physical walls of wires since these cannot exist at the temperatures required for fusion. The concept of current as merely a charge times a velocity must be used here, as was first used to describe the physics of vacuum tubes.

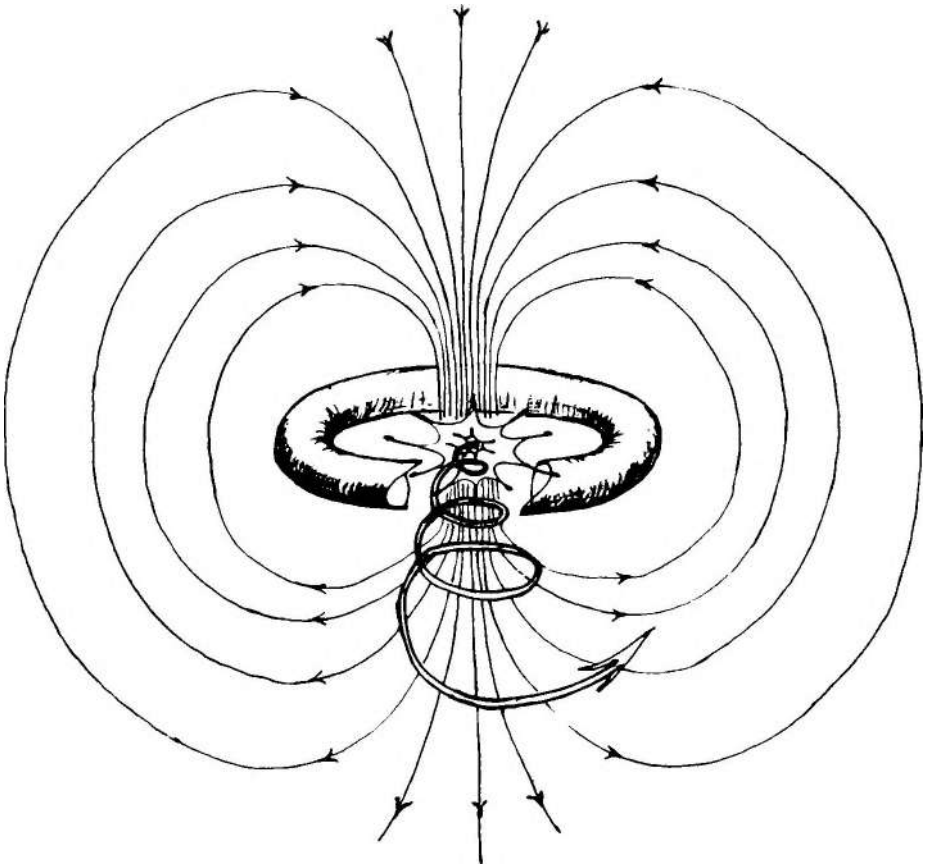


Figure 3-6: Transfer of energy to the current loop via impulsive spiraling outward of high-velocity charged particles

The magnetic field in the fusion combustion chamber is the internal part of the field from the main current ring. It is extremely strong, as we have previously determined, and essentially constant. In the containment configuration it is pinched or narrowed at the exhaust port so that only the very high energy combustion products can escape. After the injection of the plasma into the chamber, the field could be varied locally to compress and heat up the plasma until the reaction occurs.

Again, the more likely approach would be triggering by intense laser or particle beams, as it is being actively studied in the USA and Soviet Union. Once the fusion mini-explosion occurs, the very energetic combustion products exit the physical vehicle through the port. However, the energetic charged particles produced by the reaction cannot shoot straight outward as they would in a rocket engine, because the very strong magnetic field will cause them to spiral away from the vehicle. That is, the magnetic field forces a circular component of the motion to develop from any radial velocity component in a plane of parallel orientation with the main main current loop. This circular motion of charged particles constitutes a transient current loop which interacts with the main loop. Such a rapid current loop buildup tends to cause a rapid decrease in the flux passing through the main loop. A corresponding increase in the ring current is generated according to Lenz Law which is essentially a statement of the implication of the negative sign in Faraday's Law. For the interested reader the equation is given below:

$$J R = -L \frac{d\phi}{dt} \tag{6}$$

This indicates that the current density, J, in the closed loop is proportional to the rate at which the outside source, in our case the spiraling charged particles, tries to reduce the magnetic flux, ϕ, due to the current in the loop. This is similar to the process by which electrons are accelerated in the Betatron. Each pulsation contributes only a tiny fraction to the current in the main loop, which is maintained at high energy level. As the charged particles move away from the combustion chamber, they move into a gradually decreasing magnetic field area and spiral wider and wider. Gradually the instantaneous plane of their rotation rotates away from that of the main ring and some thermalize and recombine. The result of this combination is a flux change dying away much more slowly than it is built up. The fusion discharge would be pulsed at the rate needed to maintain sufficient power in the current loop.

An interesting and vital feature of this configuration is that although both positive and negative particles are produced in the reaction, the action of one does not cancel or tend to cancel that of the other. This is because, in free space, the negative particles spiral in one direction and positive particles in the other while both moving away from the vehicle in the same direction. The opposite rotation of oppositely charged particles produces similar effects on the main current loop, so that the contributions from the two types of particles add.

It appears that pulsed ignition of conventional fuels could be used in essentially the same configuration. Chemical combustion produces ions and electrons just as the fusion reaction but the percentage of ionization and particle energies would be considerably less. The combustion would have to be pulsed as in the fusion case so as to use the "transformer effect" to transfer the energy to the current ring by Faraday induction. Smaller vessels such as scout ships may use only conventional fuels, thus incorporating a simpler construction but of only a limited range.

A DESIGN SUMMARY

In summary, the hypothesized space vehicle works on a magnetic field interaction principle and not on the rocket principle. Using the magnetic fields, which pervade all of space, to "push against" requires the use of an energy source but not a source of mass on-board the vehicle, as does a rocket type vehicle. Thus, the enormous masses of launch vehicles characteristic of rockets, which heretofore have posed staggering problems and serious questioning of these devices for longer-range space missions, would be eliminated.

The proposed vehicle is illustrated in Figure 3-7. It contains a large superconducting toroid which carries an enormous current circulating about its major diameter. This current generates a strong magnetic dipole field which interacts with the ambient fields to produce lift and propulsive forces. Secon-

dary current loops working in conjunction with a large gyroscopic element provide stability and control. The system conserves potential energy, i.e. the vehicle will hover indefinitely without diminishing the current. However, as work is done, the current will diminish and must be maintained. The engine which maintains the current does so by generating bursts of high-energy charged particles in a pulsed fusion reaction. The energy is passed from the pulsed fusion reaction to the ring via the spiraling outward of the charged combustion products on the lines of magnetic force which diverge outward from the center of the vehicle, and the same mechanism protects occupants from energetic charged particles which start outward in the plane of the disc.

Some shielding of the occupants from the neutron flux is still required. The labeled parts are as follows: (a) superconducting loop, (b) fusion combustion chamber, (c) magnetic bottle shaping elements, (d) payload or cabin space, (e) magnetic field lines exterior to vehicle, (f) trajectories of charged combustion products spiraling about the magnetic field lines at the "exhaust", (g) secondary current loop for stabilization and control, (h) rotating annular section for gyroscopic stabilization, and (i) the cockpit.

The circular symmetry of the disc is consistent with the current loop and the gyroscopic element as well as with many sightings and photographs. It would be simple to construct using many identical parts, would exhibit great structural integrity, and a high strength-to-weight ratio, particularly as compared to a conventional aircraft or rocket.

The technologies involved are presently beyond our own capabilities but the concepts are not beyond our understanding, and bolstered by the continuous observations of these vehicles we should be encouraged to collect more information via instrumentation, on the one hand, and to perform experiments, on the other hand, to further prove the concepts and improve the technology in the areas indicated. Regardless of the UFO

impetus, considerable research is being done in both fusion and superconductive materials. Any breakthroughs in these technological areas may suddenly bring us to the point where the proposed design is feasible. Hopefully we will be ready.

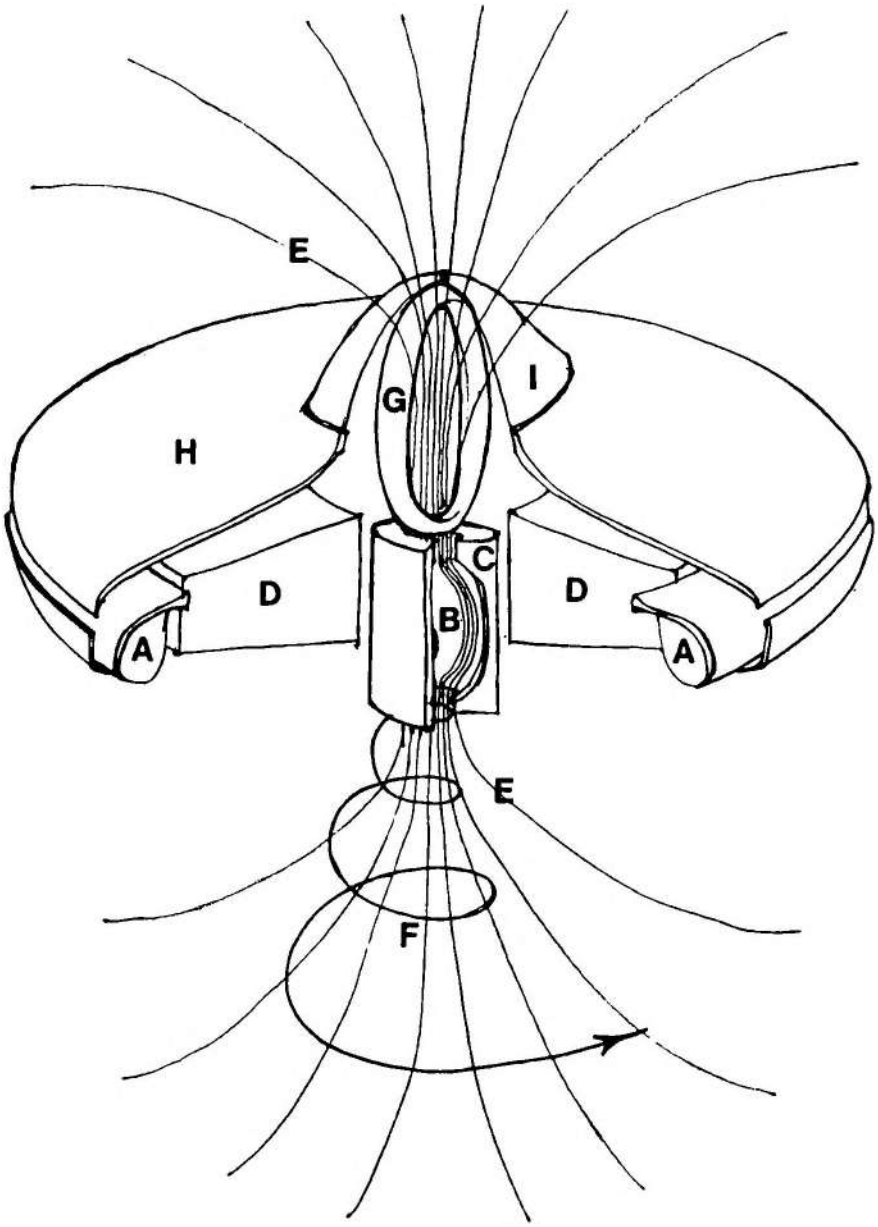


Figure 3-7: Proposed disc design summary

4. EXPLANATIONS BASED ON THE THEORY

The purpose of this chapter is to demonstrate the ability of the theoretical design of the UFOs presented in the previous chapter to explain a number of phenomena associated with terrestrial sightings of UFOs. These add credibility to the original ideas which stand rather naked up to this point.

COMMON UFO CHARACTERISTICS

This report refers rather loosely to various characteristics of sightings without providing much documentation. It seems unnecessary to reproduce many accounts of sightings when so many have already been repeated a number of times in the literature. Most of the literature on the subject of UFOs consists of the reporting or re-reporting of sightings incident after incident, often to the point of losing the reader's attention. The book entitled *The UFO Experience* by J. Allen Hynek provides the most scientific basis of classifying sightings in terms of their total information content. The NICAP report entitled *The UFO Evidence* even though it was published over 20 years ago makes a valiant attempt at cross-indexing and classifying hundreds of sightings under headings such as vehicle shape, flight characteristics, electromagnetic effects, etc. It is to these more organized treatments that the reader is referred for better documentation of the phenomena and the statistics of their observation. Some specific characteristics or sightings are briefly

quoted or paraphrased herein in order to emphasize particularly unique phenomena which fit into the theory.

Size and Shape

The physical characteristics which obviously have maintained interest in this subject are, of course, the size, shape and general appearance of UFOs. Although a great variety of descriptions are present in the literature, there are one or two which have been consistently reported for a number of years and from all parts of the world. These are the disc and to a lesser degree the cigar shaped configurations.

The most common vehicle sighted is a disc, best described as two saucers, one inverted on top of the other, often with a space between them. The upper half may have a tower or, as is often reported, merely a hemispherical dome in the center. Both types are illustrated by the sketches in Figure 4-1 based on photographs taken in various parts of the world at various times.

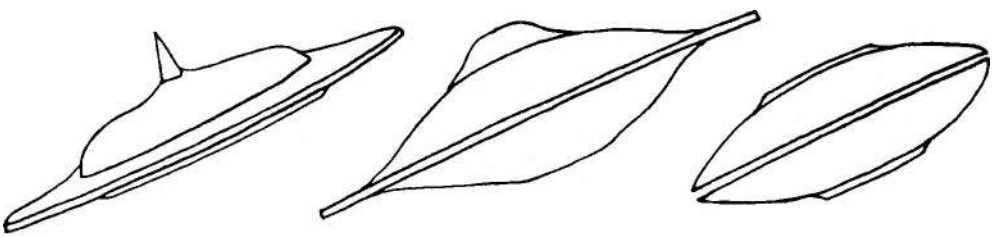


Figure 4-1: Typical UFOs

The leftmost disc typifies discs photographed in McMinnville, Oregon, and Rouen, France, in the 1950s. The Oregon disc was estimated to be twenty-five feet in diameter.

Over the last forty years there appears to have been an evolution in the design of the UFOs sighted. This is illustrated in Figure 4-1. Earlier versions, as exemplified by the Mc-

Minnville and Rouen objects, were cylindrical in nature with a pronounced rim and a tower. Subsequently the tower "evolved" into a dome and the rim moved from the base toward the centroid of the vehicle. Still later, the rim disappeared altogether and the aspect ratio decreased, with the vehicle becoming proportionally thicker along the axis of symmetry and incorporating smooth contours.

In light of the theory one can speculate that these changes represent developments in the technology of these machines as follows:

1. The pronounced rim, in the earlier version, located at the very "lowest" point in the vehicle could have been an earlier means of coping with the torque problem, by giving the maximum diameter to the gyro rotor and also placing it so as to maximize its contribution to the so-called gravitational moment due to its weight.

2. The tower has two conceivable purposes. The first is for injection of the fuel into the fusion chamber. The second is to shape the main magnetic field for better plasma containment.

3. Removal of the tower in the next generation makes the vehicle more streamlined for moving in the atmosphere, and even though the gyro rotor is moved closer to the mid-point of the vehicle, it is still quite large indicating a lot of dependence on it for stabilization.

4. More recently, all the surface features have essentially disappeared, giving good streamlining and making the vehicle more difficult to see and localize. The implication is that the stabilization system has been improved to the point where such large gyrorotors are no longer required. This could be due to larger, better controlled, secondary current loops which counteract the torque on the main loop. The increased vehicle thickness would allow larger control loops perpendicular to the main loop. Also the gyroscopic rotor has been completely integrated into the smooth vehicle shell, with either the upper or lower half of the shell rotating, a characteristic which has been observed on numerous occasions.

In consonance with numerous descriptions of discs or lights combining or splitting into multiple entities, the following quote from an actual sighting is particularly interesting in this regard:

> "...as I was gazing at this big disc, which looked like two discs, one on top of the other...then (the small discs) went back into the disc and the top part lowered itself onto the bottom part, like a clam...."

The diameter of the discs which venture close to the earth's surface is usually about five to ten meters [Vallee 99]. These size estimates are more reliable than high altitude ones because the observer naturally uses familiar objects in his field of view to aid in his judgment. Other much larger discs have been reported but these are principally sighted from aircraft where the lack of a good size reference makes these estimates less precise.

The circular symmetry of these vehicles is consistent with the hypothesis of a ring current. The current loop would be in the region between the upper and lower "saucers" near the periphery of the vehicle so as to maximize the magnetic moment which is proportional to the area enclosed by the current loop. The disc configuration maximizes the magnetic moment and strength per unit of weight. For *interplanetary* travel, a disc-shaped vehicle allows the amount of heating and cooling due to radiation from the nearby star to be controlled by rotating the plane of the disc to intercept more or less of the energy. However, for *interstellar* voyages the incident light energy will be low and fairly isotropic and the disc would be oriented relative to the ambient magnetic field in space so as to generate maximum acceleration in the desired direction.

The circular symmetry is also consistent with the hypothesis that a gyroscopic mechanism is used in conjunction with the magnetic field for control. A number of observers have described either the whole or a rim of the upper or lower

half of the vehicle as spinning. This may produce the whining sound of low intensity and is also a likely source of ultrasonic vibrations which account for the agitation of animals when such a vehicle is near. This spinning is often discontinued when the disc is hovering very low or landing. The explanation in this case is that a position is chosen at which the gradient of the earth's field is vertical, i.e. aligned with the local gravitational vector, due to the geology in the vicinity. This condition severely limits the availability of such positions, and as a result provides us with a method of testing the hypothesis by *ex post facto* measurements of the ambient magnetic field orientation at the location of a hovering UFO. Figure 4-2 illustrates how the local geologic formations can cause the magnetic field to form stronger gradients in the vertical direction, a situation which would facilitate the landing of the proposed vehicle. An artificial assemblage of rocks, such as a Mayan pyramid could perform the same function.

In Figure 4-2 the rock, G, with stronger magnetic susceptibility than the surrounding rock, distorts the normal magnetic field of the earth. Even though the normal field is not vertically oriented at the latitude shown, the anomalous field caused by the body does exhibit a vertical orientation at one point, in addition to an intensified gradient.

There have also been observed many "nests" where circular patches of vegetation have been flattened in a swirling pattern, either clockwise or counterclockwise about the center at a location where a landed UFO was observed.

Observed occasionally is a "rocking" motion of discs, a description fitting the motion, technically known as precession, which is characteristic of gyroscopes subject to external torques. A number of observers have reported discs descending using a "falling leaf" type maneuver. This indicates the the gyro is deliberately slowed to cause precession, thus reducing lift in a controllable way without reducing the actual current in the main loop. Note also that gyroscopic principles work equally

well in space as in the atmosphere and therefore satisfy a basic requirement for a spaceship.

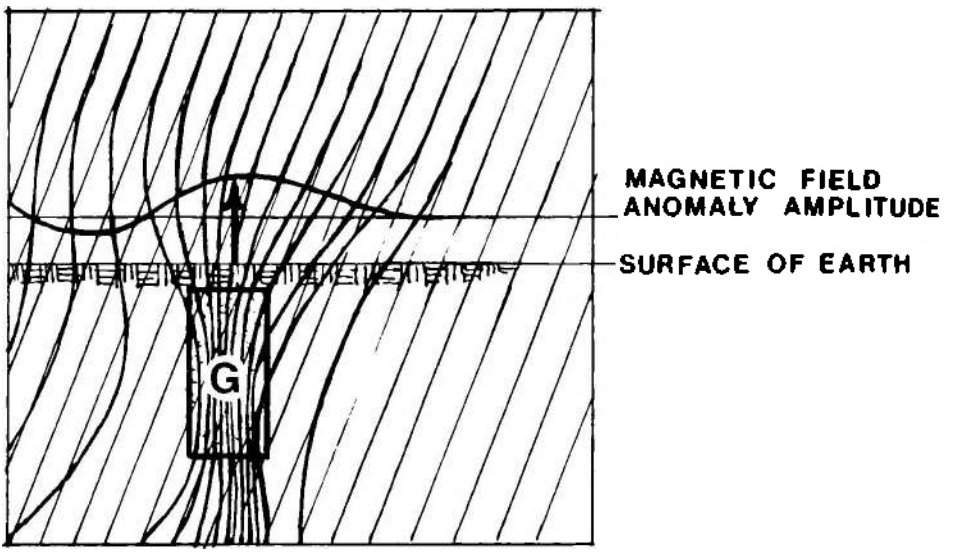


Figure 4-2: The effect of a rock body on the local magnetic field

As mentioned in the previous chapter, the vehicles probably do not utilize aerodynamics for lift. Moreover, experiments with disc-shaped aerodynamic bodies indicate that there are serious problems with this type of configuration because the center of pressure shifts relative to the center of gravity as the velocity increases. But a vehicle which can suspend itself silently in the atmosphere for periods as long as an hour, certainly does not *need* aerodynamic lift when it starts to move, since whatever suspended it when stationary can continue to do so. The disc may be a somewhat streamlined version designed for easier passage through the atmosphere but there is little evidence for this. The gyroscopic system would help stabilize the vehicle against deleterious couples generated by aerodynamic forces, as mentioned previously.

A number of people have witnessed UFOs entering or emerging from bodies of water. Based on the hypotheses developed herein, it appears that with sufficient excess energy stored in the current loop, the exhaust port could be closed to allow the vehicle to operate under water. The magnetic, gyroscopic, and gravitational principles could still function in that environment. Indeed, if beings of an advanced civilization wanted to maintain a base on earth that was relatively safe from discovery, they might well locate it under water, if their vehicles could operate in both media.

UFO Lights

Many sightings indicate a pulsating glow [NICAP 64] in and around the disc with a period of about one second, originating near the center of the vehicle. Observations are consistent with the hypothesis of a combustion chamber on the axis of the vehicle where a pulsed "burning" occurs and from which the combustion products are ejected. This is consistent with the plume clearly visible in the photograph of Figure 4-3. Many witnesses describe UFOs, the entire body of which glows uniformly from within, as if the skin of the vehicle can be made translucent. When combined with control of the color of the illumination, this might allow the matching of the vehicle glow to the ambient sky light, rendering it nearly invisible. Ancient writings [Joyser 73] from India describe Vimanas, flying machines, which could be made invisible. Scintillation of a type which is obviously difficult to describe is often observed coming from the periphery of the disc and could be due to the extremely high fields which exist in this area.

UFO Photographs

One facet of interest in this section is the quality of the photographic evidence itself, which is generally speaking, very

poor. It seems that all the really clear photographs showing good detail are hoaxes, whereas all authentic photographs are of poor quality. There are some possible explanations for this dilemma. For instance, considerable heat will be generated when the fusion reaction occurs. In the atmosphere this could cause convection currents which originate at the bottom center and rise up and around the vehicle, distorting its true shape in much the same way as convection currents near the earth's surface cause a waviness of distant objects on hot summer days. This would occur only in the case of hovering vehicles.

Another factor which may affect the quality of photographic evidence is the large magnetic fields and electric fields derivable therefrom in the vicinity of the vehicle. Although it is not our normal experience in the physics laboratory to see intense electric or magnetic fields causing optical distortion in the atmosphere, such effects as changes in the index of refraction in the presence of extremely large fields in the atmosphere are quite possible. This could essentially create a lens of high density air which would cause a distortion of the actual shape of the vehicle perceived by an observer. This effect will be discussed more completely in a later section on induced electromagnetic fields and the resulting effects on dielectric materials.

If such sophisticated effects are the cause of poor picture quality in rare cases, some much more mundane reasons can also be cited, such as the really poor quality of the average box camera, the unpredictability of a sighting and the sheer excitement of the event causing wrong camera settings and camera motion.

An interesting photograph is shown in Figure 4-3, which, although not of high quality generally speaking, is of good quality UFO-wise. Its value is enhanced by the description of simultaneous visual sighting by the boys who made the photograph. They had their camera set up on a tripod to make time exposures of the moon when the glowing disc came up

ment of the event causing wrong camera settings and camera motion.

A typical photograph is shown in Figure 4-3. This was taken on October 8, 1981, on Vancouver Island, British Columbia using a Mamiya Model 528AL 35 mm camera. Although this does not qualify as a close encounter, the capturing of natural landmarks in the photograph does aid investigators in determining its validity. Unfortunately these details are often not understood or are overlooked by those who do have the rare opportunity to photograph a UFO. In some cases photographs are taken by persons completely unaware of the UFO presence, the fact of which is recognized only after the film is developed and examined.

Figure 4-3: A typical photograph of a UFO (Courtesy of Mutual UFO Network, Inc., - MUFON)

Spectral Properties

The theory set forth in this book should allow the prediction of the spectral properties of the light from the plumes below the craft. These are highly diagnostic because of the high-energy particles produced by the fusion reaction and the enormous magnetic fields in the vicinity of the disc. The light from these reactions gives us a powerful UFO discriminator which could identify them even at distances of thousands of miles, far beyond the range at which we could measure their magnetic field directly. This is possible because the intense magnetic field at the source would cause highly unique spectral characteristics in the emitted light. The spectral "signatures" of UFOs predicted herein are discussed in detail in Chapter 5. Thus, the concrete hypothesis suggests another physical measurement, one which can be made at long range to help confirm the presence of a UFO.

Cigar Shape

In addition to the saucer-shaped vehicles which are the most common ones sighted, another is described as a cigar-shaped vehicle the size and shape of a jet liner body but having no wings. These are described as having a reddish glow throughout and possibly some exhaust coming out the back. In line with the hypothesis of current loops used for generating forces in a magnetic field and the transfer of energy from a pulsed combustion source, it is possible to conceive of a lighter-than-air craft filled with helium, and containing a current loop, but only for propulsion, not levitation. The helium could be replenished by the combustion products of the controlled fusion reaction which includes alpha particles (helium nuclei). When the methods proposed herein first become practical, this type of vehicle might be feasible for us to build prior to the saucer itself because the forces required for propulsion are less than those required for levitation. On occasion, a similar

vehicle has been observed oriented in the vertical direction. Examples of the latter type of sighting were those in France described in a book [Vallee 65] on patterns in UFO sightings. Swarms of small independently moving discs have been observed to come together and form a vertical stack, as if under remote control. This however is not consistent with the concept of a lighter-than- air machine.

Flight Characteristics

Many sightings have been made in which the UFO is estimated to have been at altitudes of less than a thousand feet above the surface of the earth. One quite prevalent characteristic of these low-altitude sightings is the erratic or irregular path which the vehicle follows. This undulating, sometimes halting or cautious type of flight, so unlike that of our aircraft, is particularly striking when contrasted with the extremely fast straight-line flight of the same vehicles when chased by aircraft, often in a near vertical direction.

Under the present hypothesis, the explanation of this irregular flight at low altitudes is simple and straightforward. Remember, the current loop causes a magnetic dipole field which interacts with the local magnetic field of the earth to produce a force. The force so generated must exactly balance the gravitational pull of the earth on the vehicle and, in addition, provide lateral forces to cause the vehicle to move as desired. To make the explanation clear, it is necessary to consider in more detail these natural fields near the surface of the earth.

Both the gravity field and the magnetic field of the earth are relatively smooth functions of distance particularly when measured at high altitudes. On a global scale the magnetic field is approximately that of a dipole, e.g., a short bar magnet at the center of the earth oriented north-south. The gravitational field is approximately a monopole field, i.e. the same as if a

single attractive point was located at the very center of the earth. These two fields pervade the interior of the earth, the oceans, the volume of space surrounding the earth.

Both fields are disturbed near the surface of the earth due to variations in the physical properties of materials in the earth's crust. Variations in the gravitational field of the earth are due to variations in the density of the crustal materials. Although such variations in the gravity field are measurable, they are relatively small, percentage-wise, as compared with the variations of the magnetic field in most areas. The magnetic field variations from point to point can be considerable near the surface to the earth and do not necessarily coincide with the surface relief or the variations in the gravity field. The variations in the magnetic field are due to differences in the magnetic susceptibility and permanent magnetism of rock formations from place to place within the crust of the earth. They occur at all scales down to distances as little as a few tens of feet. The magnitude depends upon the geology in the area of interest.

These variations, which are superimposed on the large-scale dipole field, constitute the "anomalous" magnetic field of the earth. It is mapped and studied in great detail in geophysical surveys oriented toward finding mineral deposits and petroleum. Magnetic field maps of high accuracy are compiled showing much detail and new areas are being surveyed every month. These studies of the magnetic field sometimes include the direct measurement of the vertical gradient [McPherron 99] [Ackerman 71]. The data are collected using highly sensitive airborne magnetometers towed by aircraft which fly systematically back and forth over an area until it is completely covered by closely spaced flight lines. Figure 4-4 illustrates a total magnetic field contour map and one of the vertical gradient of the magnetic field in the same area. The variations in the field are characteristic of the local geology.

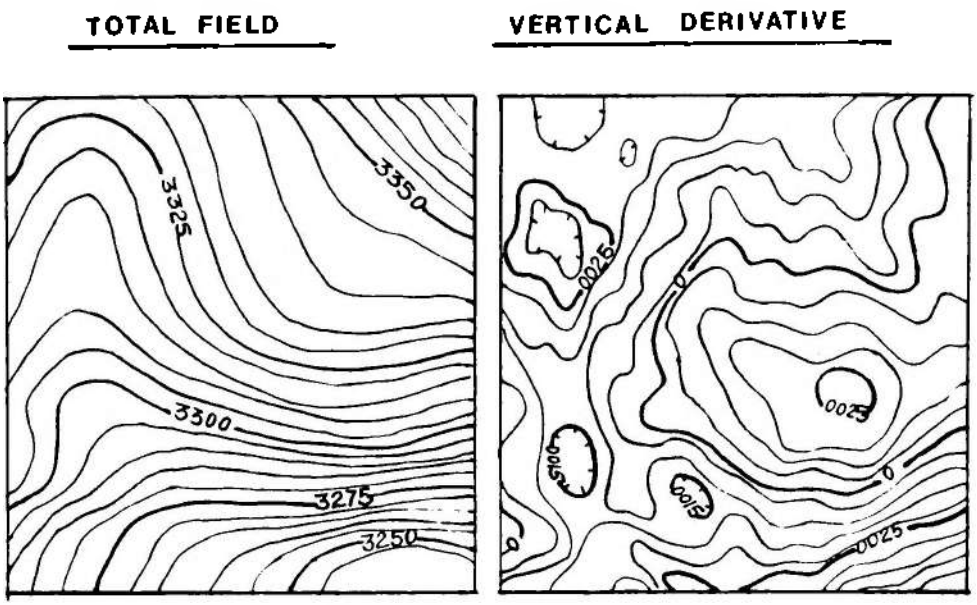


Figure 4-4: Magnetic field and vertical gradient contour maps near the surface of the earth

As mentioned in the previous chapter the forces generated between the earth's field and the hypothesized vehicle are proportional to the local derivatives of the earth's field; that is, the rate of change of the field with displacement in the *X*, *Y*, and of the earth *Z* directions. Because the derivatives vary so much from place to place the forces experienced by the magnetic field-based vehicle will be continuously changing as it moves in the field. The result will be similar to that experienced by a conventional aircraft in turbulent air or like an automobile moving over rough, hilly roads. As a result, the vehicle will not generally fly in a straight line, but follow an undulating course dictated by the local geomagnetic field variations. Moreover, the lower it descends - or conversely the stronger the local anomalies - the more frequently it will change its attitude. This is exactly the type of erratic, halting flight that is reported in many observations. Of course, these variations are much more pronounced in some regions than in others. A simple corroboration of the hypothesis would result from

demonstrating the correlation between erratic flight and strong magnetic field variations.

This cautious flight at low altitudes is illustrated by the following quotations [Fuller 66]:

> "...You take a cigar and you lay it flat on the desk. Now you stand the cigar up on one end. Right straight up and down. This is what this did. And in the meanwhile, it gave the appearance of spinning all the time....
>
> "...It would go along straight, and then it would suddenly go right up straight. And then it would flatten horizontally. And then it would drop down straight. This seemed to be the overall pattern. It wasn't done in an exactly precise way. It would jerk out. It would flatten out. So it was sort of, it wasn't smoothly done. And as they (the UFO) got closer, there seemed to be more of this jumping back and forth in the sky..."

The widespread observation of this flight characteristic is best illustrated in "The UFO Evidence" in the section entitled "Flight Characteristics."

Another example is a quotation from Dr. Hynek's book [Hynek 72]. It is derived from a taped interview.

> Q: "...There is some hilly country in there. Did the thing float right along evenly over the hills, or did it follow it?.."
>
> A: "...That was one thing we noticed. As high up as it was (500 or 600 feet), it didn't have to do the things it was doing. Whenever there seemed to be a slight rise in land it made a slight rise. When there was a dip in the land it seemed to dip. This was another thing I couldn't figure out..."

This provides rather strong corroboration of the magnetic field interaction hypothesis. The rocks making up the hills cause a magnetic anomaly or hump in the potential field and the vehicle traveling along an equi-potential surface follows the hump in the field.

Along the same lines, the escape maneuver most frequently used is a rapid near-vertical ascent. This is the simplest to implement because it requires no attitude changes, only an increase in the effective magnetic field, say, by dumping stored current into the primary loop. This gets the vehicle quickly out of anomalous field near the earth and is very effective because conventional aircraft cannot match the maneuver.

Thus, the explanation of the flight characteristics and how they differ at low and high altitudes follows in a straightforward way from the present theory. This is particularly valuable in that it lends itself to subsequent verification by *ex post facto* studies of the earth's magnetic field by the survey techniques mentioned above, in the vicinity of well established sightings. Because the magnetic field variations are much more pronounced in some regions than in others, a simple corroboration of the magnetic field dependence of the hypothesized vehicle would result from correlating instances of more erratic flight with areas of stronger magnetic field variations.

It is of interest here to recall the pyramids of the Mayas and Incas, as mentioned previously [von Daniken 99]. The motivation for building such enormous and non-utilitarian structures over a period of generations is difficult to conceive. Also difficult is the question of why they were built where they are, so far from the source of stone. Could it be that the structures were placed in an area of relatively low magnetic field gradients to facilitate the approach of a magnetically controlled vessel. Are they shaped and constructed of a material which would give a strong, symmetrical and highly localized vertical gradient in the magnetic field in which the vehicle could more easily suspend itself at landing? This could be investigated further by mapping the magnetic field in the vicinity of these pyramids. Those of ancient South American civilizations are more likely candidates since they have flattened tops with "exit" rooms, whereas the Egyptian pyramids are constructed of granite, which has a low magnetic susceptibility.

A vehicle operating on a magnetic field principle would have a number of unique capabilities compared to our conventional aircraft. First, since the magnetic field of the earth extends well out into space, a craft of this type will be able to move from the atmosphere into space and back in a completely controlled manner. It would experience no reentry problem since it could slow down outside the atmosphere and lower itself slowly to the earth. By the same token, it could hover at any altitude, either in or outside the atmosphere. At present, we are able to maintain the altitude of a spacecraft above the atmosphere only by putting it in orbit, which means that it must be accelerated so that it is moving rapidly around the earth. According to Newton's Law, there is only one altitude which permits a *satellite* to remain directly over a point on the surface of the earth, and even then the point must be on the equator. This corresponds to the unique orbit which has a period of 24 hours and an altitude of about 23,000 miles above the earth. The proposed magnetic field vehicle could remain stationary over *any* point on the surface of the earth, at altitude, while at the same time expending little or no fuel. It is not a satellite, does not stay up by virtue of its centrifugal force, but is essentially "imbedded" in the magnetic field of the earth.

UFOs have been observed entering and leaving the water in a number of cases. Since the magnetic field of the earth penetrates all bodies of water on the planet, there is no reason to assume that the proposed vehicles could not fly right into the water and continue to "fly" in that medium without altering its basic method of propulsion. The magnetic lift force may have to be reversed in direction to overcome buoyancy but otherwise the generation of lateral forces for translation and the remainder of the control system would work as in space or air. Some provision would have to be made in the exhaust system where the charged particles exit the fusion engine, or alternatively a surplus of energy could be stored in the current loop prior to entering the water.

Based on a number of observations, large starships, or mother-ships, generally remain at high altitudes and act as bases for smaller manned or unmanned scout-ships which land or at least come closer to the surface of the earth. An obvious reason for a large ship would be for long trips through interstellar space. It would carry all the supplies necessary to make life more bearable for the crew who must exist as a small isolated community for years at a time. From a technical viewpoint the large vehicle has other advantages. The interstellar magnetic fields and their associated derivatives are orders of magnitude less intense than near the earth, therefore the starships must have larger magnetic moments than the scout ships in order to generate significant propulsive forces in deep space. Of course, the forces needed in space are much less because the gravitational fields are generally weak, there is plenty of time to accelerate, and there is no air resistance. However, as the dimensions of a design are increased proportionally, the volume, and thus the mass, increases as the cube of the lengths. If the propulsion system only increases linearly, for example, an engine of twice the weight developing twice the power, the point is rapidly reached at which the design cannot be scaled up because sufficient power can no longer be generated. However, for the proposed design the magnetic moment of a current loop is not proportional to its radius but to the area it encloses, that is, the square of the radius. Thus, if a scout-ship contained a current loop of diameter 20 feet and the starship one of 200 feet, the force generated by the latter would be one hundred times greater than the former, assuming both carried the same current. Interestingly, the gyroscopic moment increases in the same proportion, so that the ratio of their effects would be the same in both large and small craft. This greatly simplifies the scaling of the proposed design to different sizes and missions.

The large ships would travel for tens of years by our time reckoning and would therefore perform gentler, more gradual maneuvers in consonance with the weaker fields in outer space. As intermediate or final destinations are approached, i.e. stars

and planets, stronger magnetic fields are present so that deceleration and maneuvering abilities increase exactly where they are most needed, because it is in these areas that gravitational forces are stronger and must be countered. The magnetic field in a terminal system may be only that due to the local star but there is considerable evidence that the planets which provide havens for life possess strong magnetic fields as does the earth. Such fields shield the planet from high energy charged particles from space (cosmic rays) which disrupt the development of life by causing mutations at such frequency so as to preclude the stability of the life forms. Thus, the probability is high that the stopping places of greatest interest in the galaxy are ones at which magnetic field-based vehicles could decelerate, maneuver, and land most expeditiously. This would involve two phases, a longer range deceleration using the magnetic field of the star, followed by a final deceleration in the more localized magnetic field of the planet.

The magnetic field interaction is a proven physical principle and is therefore certainly more palatable than the science fiction concept of anti-gravity which has never been demonstrated. Thus, instead of the science fiction concept of anti-gravity, we substitute magnetic field interactions, assuming that the magnetic fields will be stronger in exactly those places where the gravitation fields are stronger. As mentioned earlier, the earth, at our civilization's present stage of development, may be of interest primarily as a pleasant stop-over point during a long interstellar voyage. Here raw materials including fuel and food could be readily obtained, the crews could have a change of scenery and rest, as long as they could avoid the human race. This could be done by establishing bases in remote areas such as central Brazil and perhaps also under water - perhaps in the Bermuda triangle area. This would explain the relatively high incidence of sightings in areas of low population density and at night.

In the late 1970s a number of sonic boom sequences were heard off the coast of the United States. This could be fleets of starships entering the atmosphere at speeds greater than that of sound, using the cushion of the atmosphere to absorb the remaining kinetic energy.

Magnetic Field Effects

Observable magnetic field effects due to the proximity of UFOs have been reported a number of times but the problem, in most cases, is that a magnetic field itself is not easily detected. Certainly human perception does not include the ability to "feel" a magnetic field even when these are very strong. Most common electronic devices such as radios are relatively impervious to static or slowly varying magnetic fields. Slightly more susceptible are television receivers since a very strong local magnetic field will cause the picture to be shifted on the screen. This is because the electrons shot from the "electron gun" at the back of the tube are easily deflected by magnetic fields as they traverse the vacuum within the picture tube. Indeed, magnetic fields are used within the picture tube to control the electron trajectories. A number of cases are on record where people were having difficulty adjusting the television at the same time a UFO was sighted nearby. The NICAP report discusses electromagnetic effects as a separate section, and lists over a hundred sightings involving these. It does not differentiate between pure magnetic and electromagnetic effects.

A simple instrument which can sense a magnetic field is the compass. It is also a device which is used out of doors, where the spontaneous observation of UFOs is much more likely. Several sightings are on record where wild behavior of a compass coincided with the passage of UFOs high overhead. This offers strong evidence in favor of the magnetic interaction hypothesis.

It is possible to make an order-of-magnitude calculation to see how far away from the hypothesized UFO one could be and still sense a change in the magnetic field. The magnetic field is shown in Figure 4-5 as a function of the horizontal distance from the current loop. Ranges are annotated at which the UFO field strength is approximately equal to the fields associated with the devices. Maximum distances are indicated at which a compass, a television picture, and a high-sensitivity magnetometer might be affected by a current loop of the size proposed by the theory. A TV set could be affected at approximately one kilometer, a compass at ten kilometers, and a sensitive magnetometer at over a hundred kilometers. These numbers are of interest in the detection of UFOs discussed in Chapter 6.

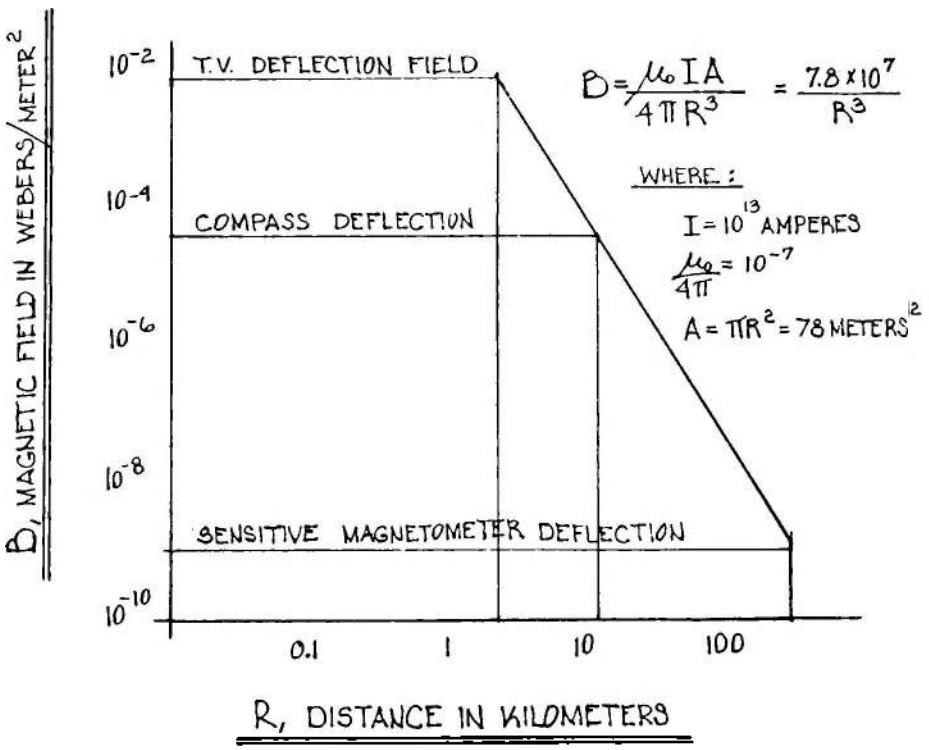


Figure 4-5: Ranges at which the UFO could interfere with various devices

At this point we should discuss instruments which are designed primarily to measure magnetic fields. The magnetometers mentioned in connection with airborne measurements of the earth's magnetic field are extremely sensitive instruments which can measure changes in the magnetic field as small as a millionth of the earth's field. Similar magnetometers are located on the ground either as a control sensor for an airborne survey or in a more permanent installation known as a magnetic observatory. Temporary or permanent ground installations are more useful for the actual detection of UFOs than the airborne sensors used for mapping because, being stationary, their output should vary only as the magnetic field in the vicinity varies. At present, a number of types of time variations are recorded at these stations, and some of these are not satisfactorily explained by scientific theory in terms of geomagnetic activity. There is a slow variation with a period of one day which is due to the alternative flattening and elongation of the magnetic field of the earth as it turns toward and away from the solar wind, respectively [White 66]. There is a whole class of variations often called micropulsations which are all assumed to come from electric currents in the ionosphere of the earth. There is a particularly striking time variation known as a "pearl" oscillation which does not seem to be correlated with any observable geophysical events [McPherron 99] & [Jacobs 70].

Temporary ground-based magnetometers are generally used more as indicators of poor magnetic field conditions (storm monitors) than from the study of time variations of the earth's field. In the case of aeromagnetic or shipborne surveys the ground station is used merely to indicate whether or not a survey flight should be made, or if the record from a flight should be accepted and, in some cases, to correct the data collected by an airborne sensor. If extreme time variations occur, the survey data cannot be used. The way in which these sensors are used in the field of geophysical survey projects is such that when variations of possible interest for UFO detection occur, they are not interpreted as to their cause and no report is made

if an unusual variation is detected. Really extreme variations, such as could be caused by a nearby UFO are generally passed off as instrument malfunction, even if a subsequent recovery is made automatically.

These ground stations could be a valuable source of data for the detection and analysis of UFOs, because they are often located in remote areas and because some are frequently moved; however they are not meant to be used for this purpose. Thus the data collected by them which might be used for the detection of UFOs is not interpreted with these phenomena in mind. The design of magnetic sensor systems specifically for the detection of UFOs is discussed in Chapter 6.

Electromagnetic Effects

Intimately related to the pure magnetic field effects discussed above are the electromagnetic effects. As any student of physics knows, electric fields are induced as a result of time variations in the magnetic field and motion of the magnetic source relative to the observer. We will discuss these two cases separately below.

The evidence of a number of sightings indicates that the UFOs, although using d.c. magnetic fields for suspension and maneuvering, have the capability to modulate this magnetic field; that is, cause it to oscillate rapidly as a function of time. It would not impair the lift or propulsion forces because the inertia of the vehicle itself makes it impossible to respond to rapid variations, and the modulation need only be a small percentage of the total field intensity. The time average of the field, or d.c. component would be used for flying, with the rapid variations being used principally as a defensive mechanism. This modulation could be a natural consequence of the rotation of the plasma-type current loop as discussed in Chapter 3 under "The Magnetic Helicopter".

It is by this means that the theory explains the rendering of automobile engines inoperable, interfering with communications equipment of pursuing aircraft, and actual heating up of such aircraft when they get too close. Although it has not been verified, it appears that such strong magnetic field fluctuations interfere with the ignition system of conventional automobiles. This has been reported in connection with dozens of sightings in which a UFO was in the vicinity of an automobile. A report on 440 such cases is available from the Institute for UFO Studies in Evanston, Illinois. There is at least one sighting in which a conventional gasoline engine was stopped by a nearby UFO while an adjacent vehicle with a diesel engine continued running. This is evidence that the electrical system is being interfered with, since the diesel engine uses no electric ignition system to ignite the diesel fuel. It might also explain the reported interest of UFOs in the old steam engines, since they would also find them impervious to the modulated magnetic field effect.

The interference with communication systems and other electronic gear may also be accomplished by interfering with the electric power in the same way although such an advanced technology could certainly be capable of more sophisticated electronic methods, perhaps some beyond our present understanding.

An effect which has been reported on several occasions both on the ground in automobiles and in aircraft during close encounters with UFOs is a rapid heating up of the entire interior of the vehicle. The explanation advanced herein is that the magnetic field variations generated by the UFO for defense purposes produce eddy currents in the structure and skin of nearby vehicles. This causes exactly the effect described, that of a general heating up of the metal shell of the vehicle.

The same defensive mechanism would explain power failures in areas coincident with UFO sightings and at military bases where attempts have been made to move offensively

against UFOs in the vicinity. There is a reported incident, not well documented, in which a Soviet missile base commander was unnerved enough by hovering UFOs that he ordered missiles to be fired at them. The report is that the missiles were detonated prematurely by the UFOs which then proceeded to knock out electrical power on the entire base in order to prevent further attack.

It seems that a relatively simple method, such as strong modulated electromagnetic fields, can handle almost any weapons system we have, probably because we have never devoted a great deal of effort in designing protection of our power sources. Both the use of electromagnetic interference and evasive maneuvering indicates that these vehicles exercise only a minimal and defensive use of the tremendous power at their hands. These actions cannot be interpreted in any way as those of an aggressive people.

The second type of electromagnetic effect is that caused by relative motion of a d.c. magnetic source with respect to an observer. Such motion results in an induced electric field at the observer's position in addition to a magnetic field. This principle is used even in the simplest electric motor or generator. Some discussion is required to relate the more familiar picture of this phenomenon to the case at hand. The strength of the electric field caused by a moving magnetic field source is given by the Lorentz equation and is proportional to the strength of the originating magnetic field and to the velocity of the source with respect to the observer.

The electric field measured by an observer as the hypothetical magnetic field moves past him is given by Equation 7.

$$E = \frac{2VIA \times 10^7}{R^3} \quad \text{mks units} \tag{7}$$

where V is velocity of the vehicle, I is current in the toroid, A is the area enclosed by the loop, and R is the distance of the observer from the vehicle.

As an example, let us consider two cases in which a current loop of 10^{13} amperes and radius 5 meters is moving with a velocity of 100 meters/sec at altitudes of 100 and 50 meters. Substituting these values into the equation we calculate that fields of 15,000 and 120,000 volts/meter, respectively, would be experienced on the ground directly beneath the trajectory of the vehicle. The field in the general area will increase as the vehicle approaches, reach a maximum when the vehicle is overhead and then decrease as it moves away.

It is possible that some of the above-mentioned interferences, particularly the stopping of automotive engines, could be due to an electric field generated in this way rather than one caused by deliberate modulation of the magnetic field, but a number of close passes are on record during which the motor remained unaffected. This indicates that the effect can be turned on or off. Besides, such a close pass would only be momentary, whereas the modulation can be sustained for a number of cycles during a single pass. We have noted the truly enormous magnitude of the magnetic field involved in our hypothesis; thus it is to be expected that some strong induced electric fields should be produced by even relatively modest motions of these vehicles. Although we are familiar with the electric shock which can be received from touching exposed wires at only 100 volts potential, this is quite different from standing in an area where everything is subjected to a large electric field. For example the potential at the earth's surface beneath a thunder cloud is typically 10,000 volts/meter, close to the lesser value just calculated. Because of the strong dependence of this function on distance, however, the value at the closer range of 50 meters is almost an order of magnitude larger. No data are presently available on the human sensations induced by electric fields of the order of 120,000 volts/meter. It

is likely the explanation for the reported feelings of a vague pressure and "prickly feeling" associated with the low altitude pass of a UFO over the observer. This is often reported simultaneously with engine interference by the persons riding in an automobile at the time of the pass. The following section presents a concept which bears on these experiences.

Some of the more unique explanations of the present theory are associated with the forces, due to induced electric fields, on dielectric materials. A simple experimental arrangement can be used to illustrate this very fundamental physical phenomenon. Consider a system of charged conductors between which is interposed a piece of dielectric material, A. The electrostatic energy of the system can be expressed explicitly as a function of the position of the dielectric material relative to the electric field. If the electric charges of the system S produce a total force component F on the body A in the direction of positive x, then a small displacement dx of the body A results in a mechanical work output from the system.

$$dW_{mechanical} = Fdx$$

The mechanical work done in the motion of A is then at the expense of the electrostatic energy W of the system so that:

$$dW_{mechanical} = -dW_{electrostatic}$$

Combining these two equations we obtain a useful relation:

$$F = -dW/dx \tag{8}$$

As a simple example, we take a parallel pair of conducting plates separated by a space into which is inserted part-way a slab of dielectric material a distance x. This is illustrated in Figure 4-6. The energy in the system is a function of x. When a voltage is applied to the capacitor plates the dielectric material will experience a net force. The force on the dielectric slab in the x direction is given by differentiating the expression for the system energy with respect to x. The force is always positive so that the dielectric is always pulled into the condenser [Scott 59].

This illustrates the very general tendency of a dielectric material to be drawn into an area of higher electric field. In the case of the hypothesized vehicle, the electric field is that produced in the vicinity of the UFO by the motion of the very intense magnetic field relative to a stationary observer. Regardless of the fact that this electric field is produced in a different way than in the experiment above, the effect is the same.

Electromagnetically Induced Optical Effects

Because the atmosphere of the earth is a dielectric fluid, it will experience a force similar to that on the dielectric slab in the presence of an electric field. Therefore the air near the flight path of the disc will be drawn toward it as the vehicle passes. This situation is of course more complex than the slab example since the electric field varies continuously in both amplitude and direction around the vehicle and because the dielectric material is a fluid as opposed to a solid.

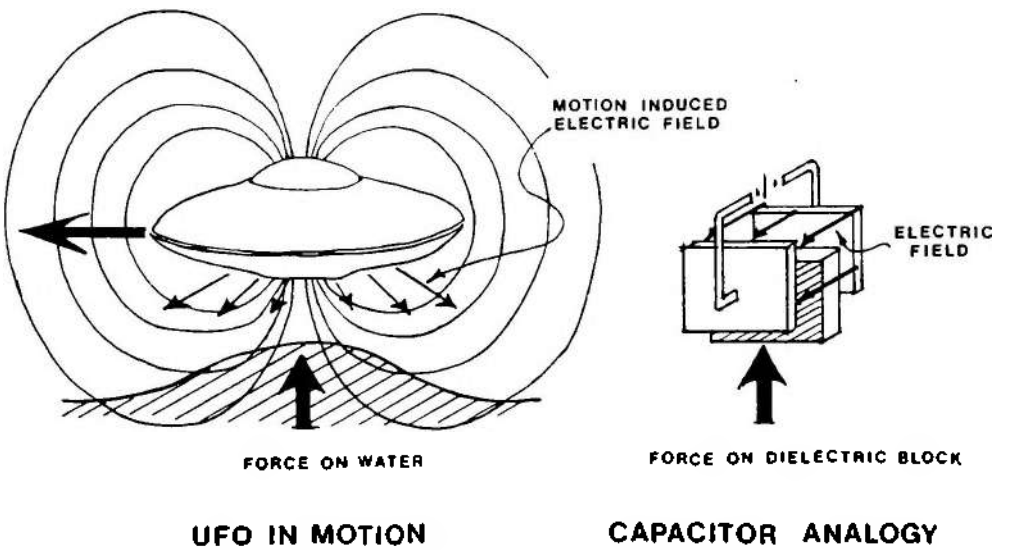


Figure 4-6: Force on dielectric materials in a non-uniform electric field

It is difficult to illustrate the electric field configuration around the vehicle since it is three-dimensional. It is a vector quantity oriented perpendicular to both the velocity vector and the magnetic field vector at each instant and point in space, and has an amplitude proportional to the product of the velocity, the magnetic field, and the sine of the angle between these two. The salient fact here is that an induced electric field will be experienced by any physical entity in the vicinity of the flying disc due to the relative motion of the two. This means a force will be exerted on dielectric materials such as air or water, or even a human being, as the vehicle passes by. The general tendency is to exert a force pulling the material toward the vehicle since the field is stronger there.

In the case of air it would pull in a "bubble" of higher density air around the vehicle when it is in motion. As in the case of the capacitor, the dielectric material experiences a force tending to pull it into the area of higher electric field. Whether or not such a phenomenon is aerodynamically significant and whether it would aid or hinder the flight properties of the vehicle is yet to be seen. It is obviously not significant in the low speed flight regime since the vehicles hover, in which case the induced electric field is zero. As the velocity increases the vehicle will draw more and more of the passing air toward its center forming a bubble of higher than ambient density. However, the air molecules will not move along with the vehicle, just toward its path as it passes and back to their original position once it passes. It is possible that this would aid its passage through the atmosphere by reducing aerodynamic couples, preventing overheating of the leading edge, and diffusing the shock wave normally produced by supersonic flight.

Along the lines of an earlier discussion concerning optical distortions, the contraction of the air into the immediate vicinity of the moving UFO would also cause an inhomogeneity in the index of refraction of the air, actually a lens, which would

move with the body, possibly distorting or obscuring its true shape in the optical or visual region of the spectrum.

A quotation concerning another sighting suggests index-of-refraction changes due to vehicle motion [Wilkins 99].

> "...Now, their instant speed and stops and their speeds in between make them invisible when in lateral motion...."

Radar Characteristics

In spite of the fact that the index of refraction at radar frequencies is not dependent on the physical properties in exactly the same way as for the light waves, the bubble of higher density air surrounding the hypothetical vehicle will have a similar bending effect on the radar waves. Although radar does not actually form an image of the target, an anomaly in the index of refraction near the vehicle could itself cause weak radar returns. The index of refraction at radar frequencies could also be affected by the injection of charged particles into the atmosphere by the fusion reaction. This effect should exhibit a pulsating component since the proposed vehicle fires its engine in pulses.

We recall the controversy over radar "angels" which is discussed on page 82 and 83 of [NICAP 64]. The report references a 1962 book on radar by Merrill J. Skolnik as follows:

> "...there must be a large change in the index of refraction over a very short distance (to account for the unexplained radar targets). Unfortunately, the refractive index gradients required by the theory are much greater than have been measured experimentally and it has not been possible on this basis to account for the observed angel radar cross-sections theoretically...".

That is, the theory predicts that large gradients would be required in the index of refraction to account for the so-called angels, but none so large have been observed in nature. As dis-

cussed above, there are several ways in which the proposed vehicle might produce such anomalies.

A related question is why the solid body of the UFO does not produce a strong radar return. The answer is really quite obvious, stemming from its simple geometric shape. Because our flying machines have such complicated shapes, they have always reflected considerable radar energy back toward the radar transmitter and so have been easily detected. The simple symmetrical shape of the disc UFO reflects the incident energy only once, and away from the incident direction so that very little is returned toward the receiver. The UFO might produce a weak return if the energy so reflected hit the earth, and a small amount of this energy returned to the receiver, either directly or indirectly, via a second reflection off the disc. In this case the "blip" would be faint, fleeting, and at the wrong range. Figure 4-7 illustrates the nature of the radar return as a function of the attitude of the vehicle. There are very special "glint" angles at which strong returns will be produced, but the vehicle can probably be maneuvered in such a way as to avoid this particular attitude.

The electric field induced by relative motion of the disc would exert attractive forces on non-conductive materials and objects other than the air if these were close enough to the vehicle. With this fact in mind we quote the following fascinating description of a UFO sighting at the Wanaque reservoir in New Jersey.

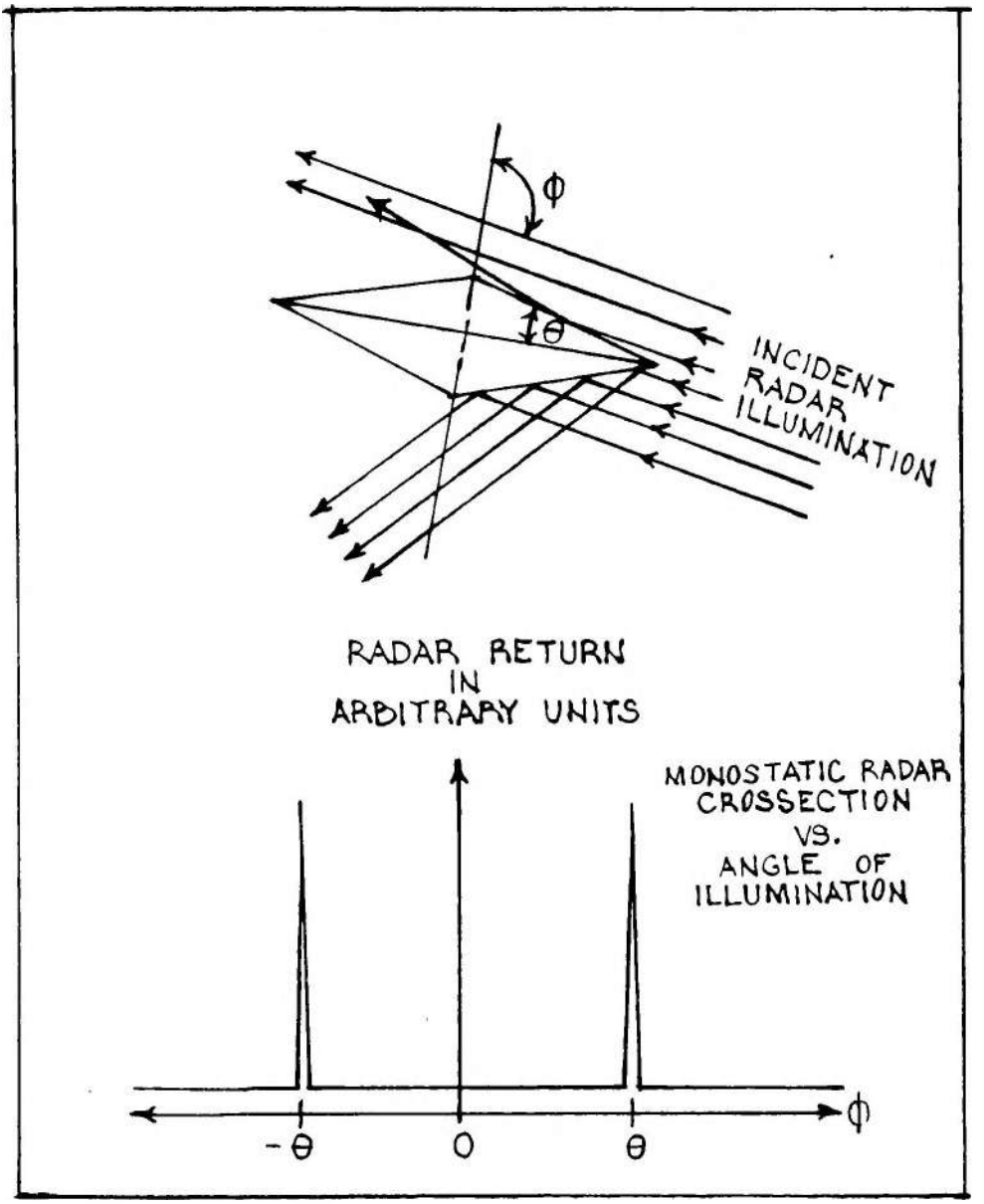


Figure 4-7: Monostatic radar cross-section of a disc-shaped vehicle

"...And as this thing faded away, from an area like, say, to the west of the one mountain, as it went over the reservoir toward the east, I could see the water come up toward this flying object. Then as

the object moved away from that area the water would settle back down to its natural level..."

"You mean," an interviewer asked, "that the water would move like a wave, or a quick tide?"

"No, the water was pulled up. It was sucked upward. But not off its bed. The flying object would just raise a whole big area of water--I don't know--for maybe two hundred and fifty feet. As far as I could see. The object would just pull at the water and I would plainly see the water rising. And when this thing flew away from the area, the water would just settle right down again.

"And that object just pulled the trees right together. The tops of the trees came right together. Each tree just mingled in with the other one. They came together just as smoothly as could be. It wasn't a violent motion. It didn't break the trees or anything like that. It would be just like somebody took a big rope and circled it around four or five hundred trees and then ran it through a chain-block and started pulling those trees together. And they'd come together nice and slow. Well, that's the way those trees acted when the flying object passed over them...."

The interviewer asked, "How high would you estimate that it pulled up the water?"

"Oh, I would say that from where I was standing--while I was looking into this light--that it pulled the water up a good two or three feet. The reservoir was low at the time and I could see the water rise plainly."

It is difficult to conceive of a lay person (a police sergeant) fabricating a picture which is so far from the normal human experience. The statements are anti-intuitive in that the attraction of water and trees *toward* the vehicle is the opposite of what one would expect of a flying object based on our experience with man-made flying machines. For example, helicopters blow objects *away* from the area beneath them. Also the smoothness with which these motions take place is at odds with our normal experience with flying objects.

The sighting has two possible explanations within the context of the present hypothesis. The first is that the dielectric material, water and trees, are pulled into the area of the greater induced electric field. The second is that the air, pulled into the area of high field around the vehicle, forms the type of enormous lens discussed previously which causes the rising of the water and bending of the trees to *appear* to happen. The latter is less likely the explanation since the lens effect would occur all around the vehicle and not just below it.

All these physical effects are qualitatively explained by the theory hypothesis, i.e., that the intense magnetic field, in motion relative to the water and trees, induces an electric field causing these things to be pulled into the area of this more-intense electric field.

UFO Affinities for Reservoirs

As a result of many UFO sightings, certain patterns are evident. Two such patterns are their affinity for reservoirs and high-power transmission lines. It is of interest here to try and explain this in light of our theory.

Recalling the problems which would be encountered by magnetically suspended and propelled vehicles due to the anomalous field near the earth, it would be desirable to have magnetic "highways" on which such a vehicle could travel at high speeds but still at low altitudes. Power lines could provide just such highways, since in their vicinity one finds stronger and more regular derivatives of the magnetic field. The objection will immediately be raised that most U.S. power lines carry a.c. current as opposed to d.c. and as a result there would result no net d.c. magnetic field on which the hypothesized interaction mechanism is based.

There are two possible answers to this objection. First, although the lines carry primarily a.c. the lines and other equip-

ment are not perfect and the inevitable result is some rectification, i.e., lower resistance to current flow in one direction than in the other, resulting in the production of a d.c. or very slowly varying component of current and therefore of magnetic field along these lines. It is a well known fact that return currents of this type flow through the earth's surface along these lines. Evidence of consistent d.c. components comes from the geophysical surveys mentioned above, in which the position of a power line is obvious on maps of the magnetic field. The magnetometers used for the collection of such data are not sensitive to a.c. magnetic fields, therefore the d.c. associated with the powerlines must be the cause.

It is probably naive to assume that because the flight mechanism is based on d.c. fields, it cannot also work on audio frequency fields. In fact, we have already guessed that an a.c. component can be superimposed on the principal magnetic fields for use in defense. This same ability could reasonably be used to ride a constant frequency electromagnetic field. Remember, the stronger the magnetic field derivatives in which the UFO suspends itself, the less of its own energy is required for suspension and motion. Therefore, the affinity to power lines seems to have a number of possible explanations under the present hypothesis.

Another reason for the affinity of UFOs to power lines might be to "steal" some of the electrical energy for the UFO's use. This is a reasonable argument, especially for the smaller "scout ships" which may utilize conventional fuels for power.

We turn next to the affinity for reservoirs mentioned above. This can be explained in several ways, simply on the basis that the scout ships usually sent down to the surface of the earth and the larger mother ship which remains at high altitudes both require relatively pure water for the mechanisms and for the beings who man them. The most logical place to obtain clean water without a great deal of notice is from large reservoirs, preferably away from the most populated areas. In

connection with this subject a very interesting and unique sighting (unique in the amount of detail obtained visually) will be related here [Edwards 66].

> "Looking through a cleft in the rock I could see a large shiny object resting on the water in the curve of the far shoreline, not a quarter of a mile across the top end of the narrows. I scrambled quickly back to where my wife was. She took one look at me and said 'What's wrong?' I tried to be calm and told her of what I had seen. Then we both climbed back up and looked through the opening. The thing was still there. It looked like two huge saucers stuck together, one upside down to top of the other. Round blackports appeared to be about four feet apart around the edge. As the bottom was resting on the water or very close to it, it was impossible for us to see the underside.
>
> "The top had what looked like hatch covers open and moving slowly around over its surface were about 10 queer looking little figures. Rotating slowly from a central position and about eight feet in the air was a hoop-shaped object. As it rotated to a point directly opposite us, it stopped--and so did the figures. Every thing seemed to be concentrated on the opening (in a rock) we were looking through. We instinctively ducked behind the stone at that moment. Looking down over my right shoulder to see how we could best get down I caught a movement in the bushes. Directly opposite us, on the far side of our cove, a deer had come down to drink. The figures and the hoop were facing the deer. As the circle or hoop began to rotate again, it did not stop at the deer as before. My wife and I would count twenty and duck. We feel that the rock before us shielded us from the action of the hoop.
>
> "We could both see that the hooplike thing was being operated by a figure on a small stand directly beneath it. This figure had on what appeared to be a bright red skull cap or helmet. All the others wore dark blue headpieces. All were about the same size: We estimated three and a half to four feet in height. All were dressed the same, with a shiny metallic appearing substance over the chest and their legs and arms covered with a darker material. At the distance (about 1200 feet) we could not make out any features--if they had any.

"The most noticeable thing was that they moved like automotons and did not turn around--that is right around as we do--but they had to turn their feet in order to change direction. I watched one of these figures pick up the end of a flexible hose (a very vivid green) and lift it while facing one way then laboriously turn the feet around in order to walk the opposite direction. During all this my wife and I could hear a steady humming sound. They seemed to be drawing in water through one hose and discharging something into the water through another hose.

"We had to duck again because of that rotating hoop and then we looked again, everything was gone from the surface of the object and it was beginning to rise from the water. It was about eight feet in the air. The water where it had rested was reddish blue, tinged with gold. The thing looked to be about 15 feet thick at the center and about 12 feet thick at the rim. There was a rush of wind as it streaked away at about forty-five degrees and was quickly lost in the distance. By having lined it up with two trees on the opposite shore I estimated that it was about forty-eight feet in diameter.

"B.J. Eyeton, Chief Chemist of the Steep Rock Mining Company and editor of the "The Steep Rock Echo", adds that others reported seeing a similar, or the same object in that isolated cove. They also mentioned what appeared to be very small manlike figures on the craft, which fled at their approach. But the report of the executive and his wife was the most detailed and Mr. Eyeton was fully satisfied as to their credibility as witnesses, since they were well known to him."

This very detailed encounter has a number of interesting facets. Both collection of fresh water and the discharging of what are probably wastes seem obvious. A more exotic use for water could be as a source of fuel for fusion engines discussed in a previous section. Water is known to contain a small percentage of heavy hydrogen (deuterium) which is a prime candidate, to the best of our present knowledge, for a fusion fuel. Also of interest is the hoop-type antenna capable of detecting living creatures. This sounds like the loop antenna on old radio direction finders, except of course that in order to detect an animal it would have to be much more sensitive and operate in

different frequency ranges. This is most likely a high-sensitivity, very wide bandpass antenna capable of detecting infrared or microwave radiation known to emanate from all living creatures.

Note the similarity in the description of the craft itself with the most common description, i.e. two saucers, the upper one inverted upon the lower but with a space between the two at the edge, also the quietness of vehicles flight. Of course, the mention of human or human-like creatures is very interesting and certainly not unique among sightings of the close encounter variety.

A Notable Sighting Report

The author attended a local meeting on UFOs at which Tom Benson of Trenton, New Jersey, related a sighting he had experienced years ago. His observations, reproduced below, are particularly rich in detail and have an important bearing on the theory presented in this book. As a result, I have, with his kind permission, reprinted them along with a brief discussion relating his observations to the theory. The sighting, as published in Tom Benson's *The Sixth Quark Journal*, Number 3, 1983, is as follows:

> "In late July (19-22) 1953 at about 11:30 pm, in Hamilton Township, Trenton, New Jersey, the witness first heard, while watching television, a sound that he would compare to a refrigerator motor. He went outside to see what the noise was about and then observed two, elliptical-shaped objects that glowed and pulsated. The objects emitted a reddish-orange colored light, both internally and externally. A brilliant white light flashed on and off, out of each porthole-shaped window on it. While the two objects hovered, they made a humming sound. The objects moved forward and as they came close to each other, an electric arc of bluish coloration shot between them. One of the two objects moved to a position about a couple of hundred feet away from the witness. He observed inside the closer object, a shadowy counterclockwise, rotating, cross mechanism with ball

forms attached. The structure of the object seemed translucent. At this time, a rotating, throbbing sound was heard that varied in pitch. One of the objects moved back to join the other. Then both moved forward at a different pace. One of the objects flew directly over the witness. The witness observed vague, but very bright light movements within a mass of light of the understructure's center and counterclockwise, rotating, white-yellowish plasma-like oval lights on the object's outer portion. A sound similar to throbbing and rotating was heard. The witness went back into his house thinking the objects were about to pass directly over it Finding they did not after observing the objects for 5-10 minutes, the witness noted that the objects now appeared at a distance as two, star-like lights. The objects continued changing velocity and altitude. The objects briefly hovered and then what appeared to be sparks, but probably was flame, shot out of their lower portion for about 100 ft., then sped off at an abrupt right angle turn, skyward. The witness observed the two objects for a few more seconds, until they disappeared out of sight."

The observations of specific interest are:

1. The motion of a wheel of lights in the position corresponding to the main current loop in the proposed design
2. The motion of a less well-defined nature in the center of the vehicle
3. The electrical discharge between the objects as they moved close to one another.

The wheel of light is in agreement with the alternate concept of the main current loop, i.e. in the form of a plasma contained within a hollow glass torus. The description of the loop as a series of separate lights is interpreted as being due to the deflection magnets which must be placed at intervals around the torus to deflect the charged particles in a circular path. The fact that these all rotate together indicates they are all part of the same rigid structure. The mechanical rotation of the main current loop agrees with the discussion of the so-called "Magnetic Helicopter" on page 51.

The vague light motion in the center of the object could correspond to the motion of the secondary current loop of

similar construction as the main loop but partly obscured by other parts in the bottom center of the object (from which a flame was observed to exit toward the end of the sighting).

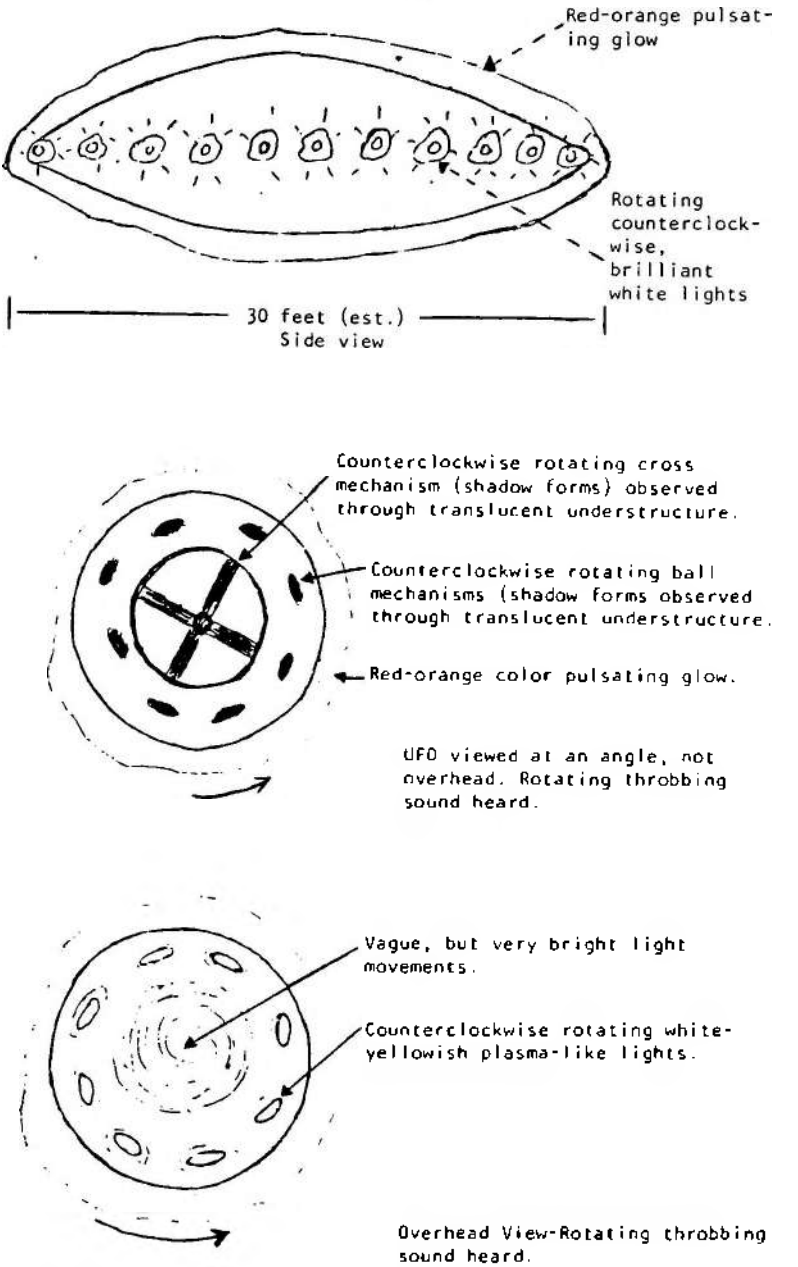

Red-orange pulsating glow
Rotating counterclockwise, brilliant white lights
30 feet (est.)
Side view
Counterclockwise rotating cross mechanism (shadow forms) observed through translucent understructure.
Counterclockwise rotating ball mechanisms (shadow forms observed through translucent understructure.
Red-orange color pulsating glow.
UFO viewed at an angle, not overhead. Rotating throbbing sound heard.
Vague, but very bright light movements.
Counterclockwise rotating white-yellowish plasma-like lights.
Overhead View-Rotating throbbing sound heard.

Figure 4-8: Sketch of UFO seen by Tom Benson

The electrical discharge is handily explained by the theory. Recalling the section entitled "Electromagnetic Effects" in Chapter 4, whenever intense magnetic fields move relative to one another, an induced electric field is created. If the relative speed and distance between the vehicles were known, it would be possible to make a rough quantitative calculation of the magnetic field generated by the vehicles, since the electric field strength required to cause arcking in air is known.

Angel Hair

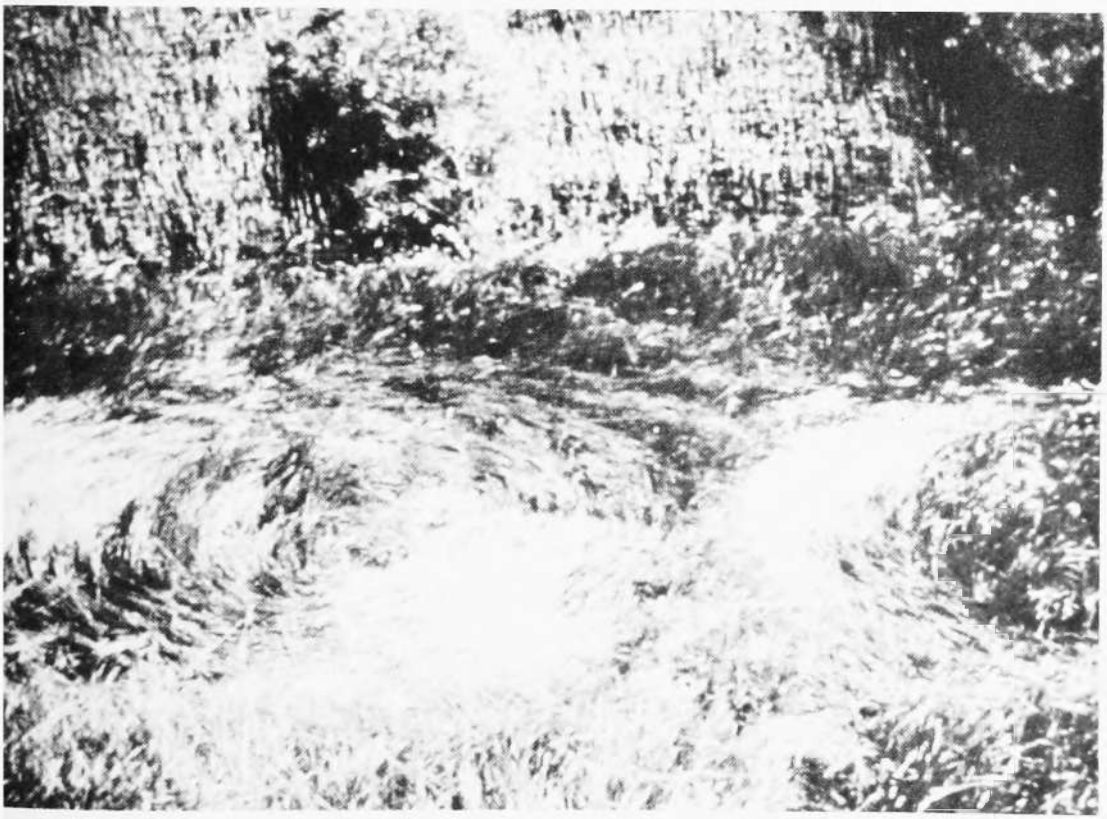
One more characteristic is of interest here because it has been reported in a significant number of sightings. This is the finding of "angel hair" in the vicinity of some sightings and the sighting of airborne objects which are surrounded with a nebulous white material. Several reports are on record in which some of the material having fallen to the earth was collected but vaporized or dissipated completely within minutes or hours leaving no residue.

The purpose of this material would most logically be to camouflage the vehicle when flying at low altitude. The two properties of aircraft that cause them to be noticed are their contrast against the sky and the sound they emit. Since the flying discs emit little sound, the only other requirement for clandestine activities at low altitude is to reduce their contrast and/or disguise their shape. An ideal solution to this problem would be to surround the vehicle with an artificial "cloud" or "angel hair". Being thus camouflaged it could drift at a leisurely pace across the sky at low altitude with complete security from detection.

The scientific capability to produce such a material is probably within our grasp but no need for such a material exists. The office of Naval Research is studying a new form of water chemically identical to ordinary water but with very different properties. It has been called "Polywater" because its structure

suggest that it is a water polymer - many water molecules bound together in long chains or sheets. Produced in quartz capillary tubes a few microns in diameters, measurements indicate it is 40 percent denser and 20 times more viscous than ordinary water. Similar manipulations of our basic molecules would be easily within the capability of the advanced technology suggested previously.

This characteristic does not contribute directly to the theory, but the very existence of such a feature when combined with all of the other characteristics adds one more link to the logical chain on which the UFO story depends.



Grass "nests" flattened by two rotating metallic UFOs. Observed by farmer Edwin Furr, Langinberg, Saskatchewan, September 1, 1974 (J. Allen Hynek Collection).

5. ASTRONOMICAL OBSERVATION OF UFOs

The electromagnetic spectrum produced by a UFO is one of the most important observables needed to confirm any hypothesis which attempts to explain the phenomenon. Properly analyzed it could convey more definitive information than a clear photograph. In this chapter the spectral signature of the hypothesized vehicle is discussed and compared with those of quasars and pulsars.

Although the observations of UFOs discussed previously were made within the atmosphere of the earth, it is quite conceivable the sightings of large spacecraft beyond the atmosphere could be made using powerful astronomical telescopes most of which are equipped with spectrometers. This would give considerable information without having to move sensitive equipment over land to remote sites in the hope of measuring their spectra at close range.

In this chapter we discuss the spectral emission characteristics of the hypothesized vehicle in contrast with those of quasars and pulsars, relatively new astronomical objects, each with temporal or spectral properties similar to those predicted for interstellar space vehicles. We are not suggesting that pulsars or quasars are interstellar craft. We are exploring the similarities which might exist between the two, with the idea that if they do appear similar, there may be some real ships hiding in the data that we should be on the lookout for.

INTERSTELLAR TRAVEL

The question which we wish to discuss first is the following: What characteristics would an artificial object, say, a large interstellar spacecraft, have, if viewed via telescope from the earth? A common view based on our dominant, chemical energy rocket technology is one in which the craft would coast without power for most of a trip with short periods of acceleration and deceleration at the beginning and end of the trip. If this were true, distant vehicles would be next to impossible to observe astronomically, while coasting, except possibly using infrared sensors. However, different designs lead to different acceleration profiles. For instance, scientists are now developing low-thrust engines like the ion rocket engines which are conceived as firing continuously for acceleration during the first half of a trip and then continuously for deceleration for the second half. This acceleration profile gives the minimum trip time between two points, assuming sufficient fuel is available. This is one example where there would be continuous energy emissions increasing the probability of observation.

Other types of engines, not necessarily rocket motors, for example, the one proposed in Chapter 3, utilizing a controlled fusion reaction could also be operated for long periods of time. This is because a tremendous amount of energy can be carried with very little weight penalty in the form of deuterium or tritium.

The Clock Paradox

The question arises as to the advantage of continuously burning the engine in light of the velocity limit imposed by relativity theory. From the point of view of an observer on earth, continuous burning of the engine to increase velocity brings diminishing returns as the velocity of light is approached. That is, the expenditure of the same amount of fuel will not

produce as great an increase in velocity at relativistic velocities as it will at lower velocities. However, from the point of view of the crew, the continuous expenditure of fuel at high velocities is desirable. The reason for this has to do with the so-called "clock paradox" of relativity and a second effect from general relativity, both elucidated by Albert Einstein.

The special relativistic effect (i.e. not involving acceleration) discussed in Chapter 2 gives a simple expression for the time compression experienced by the crew of a vehicle which is moving at relativistic velocities (i.e. near the speed of light) relative to their stay-at-home brothers. See Equation 1. The time saved is a function of the vehicle velocity relative to other frames of reference.

The general relativistic theory expounds a related effect which also would shorten the trip time as measured on board certain aircraft. The effect is that time passes more slowly in an accelerated frame of reference than in an unaccelerated one. A vehicle, which leaves earth, travels to a distant point and returns to earth, has been accelerated several ways. The magnitude and direction of the velocity has been changed a number of times or perhaps continuously during the trip. If the acceleration, integrated (summed) over the entire trip is greater than that on the home planet, the traveler will have aged less than his stay-at-home brothers. The actual amount of the difference is not simple to calculate but would be proportional to the magnitude of the acceleration difference and the time for which it is maintained. The effect would reduce the aging of the occupants during long space voyages. The fact that such time-savings could be realized by spaceships of an advanced type obviously has a bearing on the length of trips which would be feasible in interstellar space. The expenditure of energy required to maintain acceleration throughout the flight would increase the chance that astronomical observatories could detect these objects via their emissions. Naively speaking they could be discriminated from natural objects by the large doppler shifts in

the spectral lines of the light they emit, those moving toward the earth exhibiting blue shifts and those receding exhibiting red shifts. However, there are other factors to be discussed in the following section, which have a bearing on this spectral shifting. Also we would expect some of these light sources, i.e. those not moving directly toward or directly away from the earth, to display angular motion different than the stellar background. In astronomical terms this is known as proper motion.

PREDICTED SPECTRAL SIGNATURE

Picturing the type of vehicle described in the earlier chapters, the passage of the ship and its associated magnetic field through the interstellar material will create a turbulent "wake" which will cause considerable radio emissions over an extended area perhaps exhibiting two lobes due to the influence of the magnetic field on positively and negatively charged particles. Aside from this wake, the hypothesized vehicle will manifest itself by two other sources of energy; radiation direct from the fusion furnace and from the exhaust plume outside the vehicle. Depending on the relative angular orientation of the vehicle, an observer might see either of these or a combination thereof.

Blackbody Radiation from the Fusion Furnace

If the "exhaust pipe" is directed toward the observer he will observe emissions directly from the pulsed fusion reaction itself, at a temperature of hundreds of millions of degrees. Although stars utilize such reactions to generate their energy, the reactions occur deep in the stellar interior and are shielded from our view by the cooler outer layers which are not at such high temperatures. Therefore, one cannot expect this radiation to resemble the spectrum of any known stars. Considering the very high temperature of the fusion reaction, it is likely that no emission lines would be present in the spectrum from the fur-

nace because all the electrons will be stripped from the atoms. The resulting continuum radiation would probably resemble a blackbody with a temperature of 100 million degrees. The atmosphere of the earth would absorb the ultraviolet and X-ray portions of the spectrum so that it might be difficult to determine the true distribution unless observations could be made outside the atmosphere.

Synchrotron Radiation

As the charged particle exhaust spirals out through the exhaust port, several interesting phenomena will occur. Synchrotron radiation will be generated due to the high acceleration of the spiraling combustion products, and recombustion radiation will result as the positive particles and electrons begin the process of recombining into atoms. The normal spectral characteristics of these two processes will be spread out by several mechanisms. The particles will be moving rapidly from the region of the strongest magnetic field into a weaker field area while at the same time decelerating. Since synchrotron radiation is characterized both by the magnetic field and the particle velocity, and both vary considerably over a short distance in the vicinity of the proposed vehicle, the normal synchrotron spectral distribution may be somewhat distorted. Also, since electrons and positive ions have such different masses, the spectra due to the two should be bimodal in nature.

Recombination Radiation

The recombinations of the positive ions and electrons in the exhaust plume will produce line spectra characteristic of the elements involved in the fusion reaction. As mentioned in the previous chapter we would expect primarily deuterium and helium. However, if the fusion engine was very advanced, fur-

ther fusion of the first-stage combustion products could produce some heavier element whose line spectra would also be present in the light emitted from the exhaust plume. Of considerable importance, there are two physical mechanisms which would make these line spectra highly characteristic of the UFO. Splitting of the spectral lines into triplets will occur due to the extremely intense magnetic field near the vehicle. This is known as the Paschen-Back effect. The amount of splitting is a direct measure of the magnetic field strength at the source. This radiation consists of two components polarized parallel and perpendicular to the magnetic field. Two components in the plane perpendicular to the field propagate with linear polarization and one parallel to the field with circular polarization. These are illustrated in Figure 5-1. This is a particularly diagnostic measurement predicted by the theory, which if made, would come very close to an absolute proof. The question is whether there are sufficient numbers of free electrons in space to produce detectable recombination radiation.

Relativistic Effects on Emitted Light

The application of a basic concept of relativity theory to this situation provides additional mechanisms for both a red shift and line broadening. If we picture the combustion products whirling about the powerful magnetic field lines as seen when looking at the exhaust plume along the vehicle axis, the ions are experiencing phenomenal accelerations. In the accelerated frame of reference (centrifugal acceleration here) all clocks will run slow, and since the frequency of any emission, which results in a spectral line, is a type of clock, it will also be slowed down. Such a slowing down results in a lower frequency, precisely what we call a red shift. Thus, a red shift in the emission from the hypothesized vehicle need not imply a translational velocity of recession. Indeed, the vehicle could be approaching the earth at relatively high speed causing the observed spectrum to be slightly blue shifted due to the Doppler

effect but because of this relativistic red shift, would appear to be approaching less quickly or even receding because the accumulative shift is red and would normally be interpreted as due to the Doppler effect.

Vehicle Aspect

The hypothesized design advanced in earlier chapters utilizes pulsed "burnings" of the engine, each of which would produce synchrotron radiation due to the charged combustion products whirling in the strong magnetic fields of the vehicle itself. Such a vehicle when viewed from the edge-on aspect of the disc will be seen primarily as a pulsed source of synchrotron radiation. It will be pulsed in phase with the fusion furnace, but radiation directly from the furnace will propagate in the orthogonal direction and therefore the two may not be observed concurrently. If the acceleration of the particles is great enough, it is possible for the continuous spectrum of the synchrotron radiation to reach into the visible portion of the spectrum. Both high particle energies and a strong magnetic field contribute to this tendency.

An additional point should be brought out in regard to the question of aspect. The type of vehicle hypothesized in this report would not simply be oriented in the direction one wishes to move. The forces generated depend on the relative orientations of the vehicle magnetic moment and the magnetic field gradients in the vicinity. In a way, this is similar to the orienting of a sail relative to the wind in order to produce motion in a direction different from both of these. Thus, an arbitrary relationship exists between the direction of travel and the orientation of the vehicle since the direction of the interstellar magnetic field gradient will gradually vary throughout space due to concentrations of plasmas and stars.

Summary of UFO Emissions

In summary, the hypothesized space vehicle is expected to emit light from three separate physical processes, each with different spectral characteristics. First, radiation directly from the fusion furnace with black-body distribution but with no line spectrum due to the fact that all the atoms involved are completely dissociated into nuclear particles and electrons. Second, synchrotron radiation due to the charged combustion particles which make up the exhaust plume whirling in the intense magnetic field near the vehicle. Third, the line spectrum produced as the positively charged nuclear particles recombine with electrons in the process of forming stable atoms.

Two mechanisms were discussed whereby the line spectrum could be red-shifted; the Doppler effect which depends on velocity relative to an observer and a relativistic effect due to the high acceleration which the recombining atoms are experiencing at the time they emit the light.

At least two mechanisms are present which might cause line broadening; the smearing of the relativistic red shift due to the fact that some emitting particles are being accelerated more than others, and the smearing of the Paschen-Back effect which predicts the splitting of spectral lines into triplets, due to the fact that different recombining particles emit when in different positions within the magnetic field of the disc. Neither of these effects should interfere with our ability to determine the magnetic field from the separation of the triplet lines.

The different types of radiation, and the attendant effects propagate only in restricted directions relative to the vehicle axis. This is illustrated in Figure 5-1.

In the interest of completeness, the predicted spectral signature for a UFO within the earth's atmosphere should also be mentioned here. The charged combustion products will encounter air molecules and energy will be given up on passage

through them. Thus, the primary difference between the signature in the atmosphere and that in space will be the presence of Bremstrahlung (breaking radiation), the resulting dissociation of air molecules and atoms and their subsequent recombination. The spectra produced by these phenomena will be superimposed on the recombination spectra of the exhaust nuclei themselves. The recombination spectra should be enhanced due to the presence of many more electrons. The air will also scatter the various forms of light so that there will be a mixture of the various components.

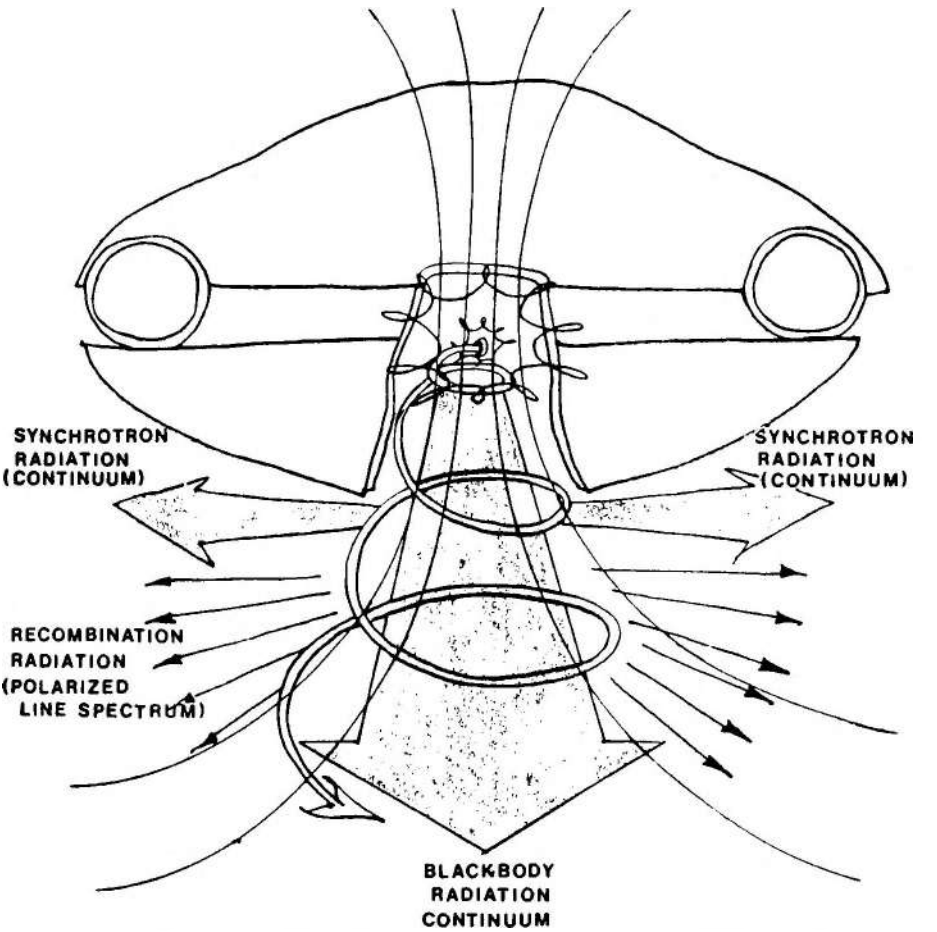


Figure 5-1: Light from different sources associated with the disc propagate in different directions.

QUASARS AND PULSARS

Having reviewed the predicted spectral characteristics of the hypothetical spacecraft, it is of interest to discuss also the observed properties of two transient astronomical phenomena, pulsars and quasars. Because, in spite of the fact that they have quite different characteristics, there are aspects of both which are similar to the predicted UFO signature.

Pulsars

Pulsars were originally detected by radio telescopes because they emit extremely short bursts of radio energy at very regular rates between 1000 and 0.25 times per second, each having its own characteristic rate. The most popular theory is that they are rapidly spinning neutron stars containing extremely dense nuclear matter which were formed at the center of a supernova by implosion when the main mass exploded outwards. The shortness of the bursts, usually less than 50 thousandths of a second is explained by picturing the radiation being emitted in a narrow cone which rotates with the star, creating the so-called lighthouse effect. The explanation of how the radiation is confined to the cone is very weak. Careful study of the pulse timing indicates that all are slowing down by minute amounts, a fact which is adequately explained by the theory as a gradual loss of energy. However, sudden large increases and decreases in pulse rates have been observed and even one instance of a phase change with no associated change in rate. Also, more recent discoveries of pulse rates as high as 1000 per second have been made. These sudden changes and high pulse rates do not fit very comfortably into the neutron star theory.

Another interesting aspect of the pulsars is their large proper motions which have been estimated, based on the presently accepted theory to represent speeds between 45 and

500 kilometers per second. These speeds are explained as being due to their formation in the catastrophic implosion of an unstable star. These velocities are highly speculative, since they depend heavily on estimates of the range of these objects which could be substantially in error.

Although all pulsars were originally discovered as a result of their rapid pulsations in the radio spectrum, careful observation has resulted in the detection of a light source for several of these pulsing exactly in phase with the radio energy. Both optical and radio pulses show significant linear polarization, with the plane of polarization rotating through a definite angle as each pulse passes the observer. No emission or absorption lines are detectable. The radiation is emitted over such a wide range of wavelengths from the shortest x-rays to the longest radio waves, that no thermal source could produce it. Shklovsky [Sagan 68] suggested in 1953 that the radiation arises from electrons whirling in a magnetic field inside a nebula; the type of radiation called synchrotron radiation.

Quasars

Quasars, like pulsars, were originally discovered by radio-telescopes and as more exact positions of the radio sources became known, a visible source was identified with each, but of smaller angular size than the radio source. The radio source is often bicuspid, and visible plumes or wisps appear to be associated with a number of them. The radio energy is not pulsed but can vary in strength by a factor of two in as little as one day. The optical source is primarily a continuum with a distribution and polarization which has been described as similar to that of synchrotron radiation. Although some similar objects exhibit the continuum radiation only, these are not defined as quasars because the unique feature that defines the quasar is its strongly red shifted line spectrum, and the amount of shift cannot be determined if no lines are present in the spectrum. The quasar

emission lines present are all quite broadened, some as wide as 100 Angstroms. Permitted (strong) lines tend to be broadened more than forbidden (weak) ones. Some quasars exhibit sharp absorption lines usually with less red shift than the emission lines. Quite unlike pulsars, they exhibit no measurable proper motion, a fact which strongly implies that they are very distant, and therefore objects of cosmologic origin. The current, most accepted theory is that the quasar is the active core of a proto-galaxy, which is perhaps radiating in the infrared spectral region.

The quasar presents a paradox to modern astronomy. This paradox is rooted primarily in the large red shifts of their line spectrum. The red shift has been used for many years as a gauge of distances to remote galaxies. This linear relationship between red shift and the distance to a galaxy is interpreted as due to rapid motion of the light source away from the observer (the Doppler effect), and is known as Hubble's Law. It is based upon the theory that the universe is expanding uniformly, with every observable galaxy moving away from our galaxy, and the distance from us being proportional to the speed of recession. Applying this law to the quasar red shifts would indicate that these objects are more distant than any yet known to man. The paradox lies not in this great distance itself, but in the energy the source would have to radiate to be detectable at such a distance. The apparent size of the objects is below the resolution limits of the best telescopes, giving only an upper bound to their true extent. The relatively rapid fluctuations in the energy received from the quasars, i.e. of the order of days, provide additional clues as to their size since the time required for a luminous body to change its brightness cannot be less than the time required for light to propagate from one end of the body to the other. Galaxies are typically a hundred light years in diameter. However, if the quasars are at cosmological distances, then the amount of energy being radiated is greater than that from the largest observable galaxy. No mechanism is

known which could generate such enormous power levels in such a small volume.

This impasse has led to another school of thought which reasons that the red shifts are not due to the velocity of recession but to a relativistic (non-Doppler) effect. In this case, Hubble's law would not apply and the sources need not be very distant or particularly powerful radiators. The only red-shift mechanism which has been suggested is due to an extremely massive body with gravity so strong that the light is "slowed down" in frequency or red-shifted as it escapes. Not only would this require a very massive body but one in which the mass is compressed into a relatively small volume. If these objects are nearby (i.e. not at cosmological distances), however, it is difficult to explain the lack of proper motion in any of them.

Discrimination Between Astronomical Objects and UFOs

The purpose of this discussion of transient astronomical phenomena and the hypothesized spacecraft is to provide a basis for discriminating a UFO which might otherwise be passed over because of similarities to the quasar or pulsar. There are a number of features of the pulsar which correlate in a positive way with those of the hypothetical vehicle described in the previous section. A spacecraft of the type discussed, when viewed edge-on would emit pulses of synchrotron radiation, and the plane of polarization would change as the particles moved away from the vehicle following the curvature of the magnetic field lines. Those vehicles not heading directly toward or away from the earth would exhibit considerable proper motion, and the glitches (sudden changes in pulse rate) might occur due to changes in "throttle" settings by whoever was controlling the vehicle. Generally the pulse rates expected from UFOs will be much lower than pulsar rates. The synchrotron radiation from UFOs should be detectable in the

visible as well as the radio spectrum. It there are sufficient electrons in the vicinity the line spectrum triplets should be present for UFOs, but not pulsars.

In what respects do the observed characteristics of quasars resemble the hypothetical spacecraft? The presence of the continuum radiation with superimposed line spectrum, the broadened spectral lines, and the fact that large red shifts are present all correlate positively. The wake of an interstellar craft could appear as a larger radio source associated with the vehicle, and might be bicuspid due to the dipole nature of the magnetic field or the presence of both negative and positively charged particles. The continuum radiation resulting from looking into the fusion furnace is predicated to be pulsed, not polarized, and to possess a blackbody distribution. Most likely the detectors used to study quasars are not sensitive enough to detect short pulses of the duration expected from the UFO.

It is possible that a blackbody distribution due to a source at 100 million degrees would not be recognized because it comes from a source which is so much hotter than astronomers are accustomed to observing and because the most definitive portion of the distribution is lost from our view due to absorption of ultraviolet and X-ray radiation in the atmosphere of the earth. Along these lines, Oke [Burbidge 67] has advanced the controversial idea that the quasar continuum could arise from a very hot gas, of the order of a half million degrees. Quasar 3C273 shows a marked increase in flux in the near and far infrared, which definitely does not match a single thermal distribution. A similar observation might occur in the case of an interstellar craft, where the blackbody radiation from the body of the vehicle at, say, 300 degrees Kelvin would be superimposed on that from the fusion furnace causing this anomaly.

The line spectrum of the quasar indicates the presence of H, He, C, N, O Ne, Mg, Si, S and Ar. The relative abundance of these light elements is approximately that found in the sun and in neighboring stars with the possible exception of helium

which is even absent in some spectra. If quasars are of cosmological origin and thus are such extraordinary objects, this is indeed a surprising finding because we do not expect that the ratios would remain the same over the billions of years that the light has been in transit. Our theory hypothesizes that the interstellar craft are powered by fusion of light elements - deuterium is heavy hydrogen - therefore one would not anticipate so many heavier atoms in the "exhaust". However, a really advanced system with magnetic field strengths of the magnitude proposed herein might well be able to retain the primary combustion products as do the stars and extract more and more energy by fusing these into heavier and heavier nuclei. The deficiency in helium could be the result of complete secondary fusion of helium nuclei, but this seems unlikely. Also we anticipate deuterium, not hydrogen in the UFO exhaust.

All quasars exhibit red shifts of such magnitude that many scientists interpret, using Hubble's Law, to mean they are the most remote objects yet observed by man. Interstellar craft could be either receding from or approaching the earth, and would therefore exhibit red shifts or blue shifts, respectively, unless a general relativistic effect, such as discussed earlier, could completely overwhelm any blue shift - an unlikely happening.

A strong argument for the theory that quasars are very distant cosmological sources is the lack of any measurable proper motions. A universal trait such as this is important especially where there are considerable differences from object to object in other regards, such as the presence of absorption lines, the amount of red shift they exhibit, the degree of line broadening, the distribution of the continuum radiation. UFOs should always exhibit some proper motion; indeed this might be so rapid as to preclude observation by astronomical telescopes.

It is not the purpose of this discussion to imply that either pulsars or quasars are indeed large interstellar spacecraft. But the fact that a well defined hypothesis is put forth concerning

the design of an advanced spacecraft makes an objective comparison of the hypothetical and observed characteristics possible. There are some positive and some negative correlations between the predicted characteristics of the spacecraft and the astronomical objects. Of the two classes of objects, the large proper motions of the pulsars and the very short pulses give significantly greater chance that an interstellar craft might be mistaken for one. However, the fact that all observed pulse rates are so high and are decreasing minutely with time is a very strong indication that those with this characteristic are natural objects. Nevertheless, astronomers should be on the lookout (that's their job!) for transient objects, particularly those with unusually large proper motion, having the characteristics of the UFO suggested herein.

A FUNDAMENTAL NATURAL PROCESS

We recall here the mechanism proposed in Chapter 3 whereby energy from a controlled explosion "hot" enough to produce charged combustion products, produces or rather maintains the circulation of electric current in a closed loop surrounding the explosive source. To the best of our knowledge, this type of engine has not been specifically recognized in any scientific literature to date, even though it seems closely related to areas such as magnetohydrodynamics.

The process whereby explosive bursts of charged particles transfer energy to a remotely circulating electrical current loop via the inherent magnetic field may be important in understanding several processes in the natural world. Two possible examples are the spiral galaxies and the maintenance of the magnetic field of the earth.

Spiral Galaxies

The spiral galaxies have a flattened disc-like shape with a dense and apparently active core. The highly ordered structure of these is most impressive when viewed nearly edge-on. The most likely condition which could lead to such a unique shape is an ambient magnetic field since this would establish a preferred direction in what would otherwise be isotropic space. Only charged or ionized matter would be affected by the magnetic field, but in the formative stages all galactic matter is probably charged. It is generally accepted that tremendous explosions, perhaps supernovas, occur relatively frequently in the core, particularly in the earlier stages of formation. These would tend to keep the surrounding matter ionized so that it would be influenced by the ambient magnetic field.

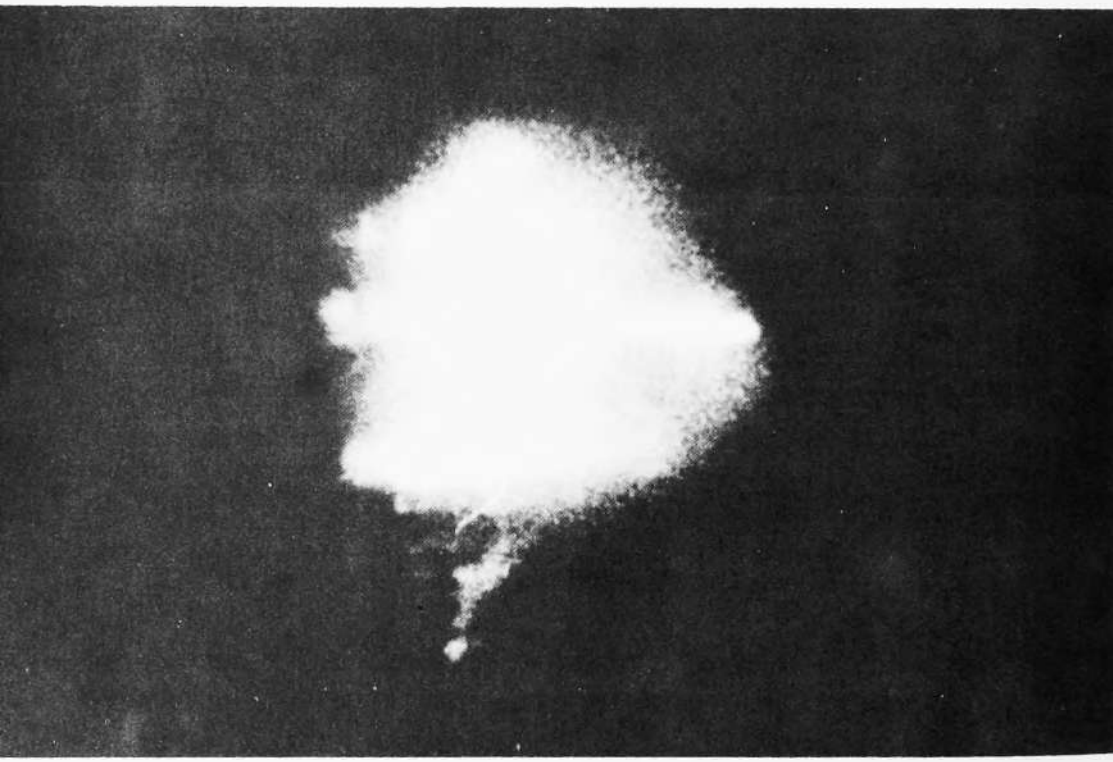
Consider the analogy between this proto-galaxy and the spacecraft design proposed in Chapter 3. The ionized matter circulating in the galactic disc constitutes a closed current loop. It produces a galactic magnetic field shaped the same as the proposed UFO. The explosions at the active core of the galaxy exert an accelerating force on the ionized galactic matter which is circulating in the system. The magnetic field provides the mechanism for transmitting the energy to the rotating galactic matter thereby storing it in the magnetic field.

The Geomagnetic Field

Also consider the current loop within the earth which is the source of its magnetic field. The mechanism by which this field has been maintained over geologic time is not understood. In light of the concept advanced in this report it does not appear that the bursts of charged particles needed to pump up the current loop must come from the interior of that loop. Such bursts coming from a remote source such as the sun will spiral into the magnetic field of the earth transferring their energy to

the current loop buried in the molten core of the earth, via the same inductive mechanism proposed in Chapter 3.

Perhaps this is a very fundamental process which manifests itself in various phenomena in the natural world and is utilized by advanced technologies in their machines. If our speculation concerning this new principle is correct, it is a bit ironic that it has been discovered as a result of an investigation of UFOs rather than the natural manifestations. As with all new concepts, however, the process is one of syntheses--the piecing together of existing knowledge in a new pattern. It is only the subtlety of the clues which causes us to classify the process as inductive or deductive.



Bob Campbell, Sherman, Texas. (August 2, 1965) - The photo is a two minute time exposure made by the T.V. newsman while accompanied by a policeman. The bars of light within the glowing mass are very similar to the UFOs in the Salem, Massachusetts Coast Guard photo (Courtesy of Mutual UFO Network, Inc., - MUFON).

6. VERIFYING THE THEORY

The actual truth about UFOs or flying discs has yet to be determined. Unless such a determination is actively sought by us, it may be a long time before the facts are established by chance. Up to now it has been difficult to mount such an endeavor because of the controversial nature of the subject and the disorganized state of the data continuously being received from all parts of the world.

A theory such as that advanced in this book helps in the latter regard, advancing as it does specific physical phenomena to account for the observations. It allows us to design precisely defined measurements and experiments which can relatively quickly establish or discredit the proposed theory. This is particularly true in light of the extremely large magnitudes of the measurable physical quantities proposed in Chapter 3 which, if shown to be correct, cannot be interpreted as due to any known natural phenomena.

Two approaches are available for verifying the hypotheses advanced herein. The first is to assemble scientific apparatus for directly observing UFOs, such as magnetometers and spectrometers, hoping that a chance will present itself for making an observation. The second approach is to design laboratory experiments to verify the proposed physical phenomena where possible. The second bypasses the first in the sense that some aspects might be verified in a relatively short time. Conversely, the principal result of a positive UFO observation would inevitably be the commencement of these same experiments in order that we could work toward the

development of such vehicles ourselves. Both of these approaches are discussed in this chapter.

DETECTION OF UFOS

The purpose of this section is to propose some specific instrumentation and detection systems which can be used for identifying UFOs, based on the theory presented in the previous chapters. One problem, of course, is the random nature of terrestrial sightings. How does one get the equipment in the vicinity of the transitory UFOs, so that the measurement can even be made? Although this is a difficult problem, it is certainly not without analogies in our modern world; for instance, the coverage of fast breaking news events, or the documenting of a rare species mating.

A sound approach for making terrestrial observations of UFOs would be to fabricate a complete instrumentation package in a van which could be transported via aircraft to any area in which UFO activity is reported. Such an observatory would have to be rugged and self-sufficient enough to stay for several weeks in areas which are rural, backward, and where weather conditions are far from ideal.

Recalling the instances in which vehicles with conventional (gasoline) engines have been stalled by nearby UFOs, it would be advisable to use diesel engines for transporting these vans to the site. Of course, the intent is not to chase them but rather act as a passive, clandestine observatory. Along these lines, a better reason for using a diesel engine would be to eliminate the electric ignition system which inevitably generates electromagnetic radiation over a broad spectrum, thereby making the presence of the vehicle less easy to detect during the arrival stage of the operation.

Electrical shielding of the entire instrumentation package will be necessary in order to minimize the chance of counter-

detection. At the same time it is also important that the various instruments not interfere with one another. This is a tractable design constraint which is dealt with everyday, in both commercial and military electronic systems.

The design of the observatory must take into account reported cases in which UFOs made close passes to the observer ostensibly to fog film, erase magnetic tape, and interfere with radio communications. Such a capability would be easily within the reach of an advanced technology, such as that hypothesized, for example, using an x-ray laser and by modulating the enormous magnetic fields which are inherent in the design.

It is not necessary to design instrumentation which could operate over the entire dynamic range of possible measurements involved in such a close pass. A more intelligent approach would be to integrate good, sensitive detectors for the purpose of making measurements at a reasonable distance from the observatory, so as to cover as large an area as possible. Rather than try to make measurements during a near pass, the design should endeavor to protect the data gathered while the UFO is within the desired range. For example, film magazines could be made of heavy lead, and magnetic tape containers made with multiple air-spaced layers of magnetic shielding material with different permeability.

Based on the theory presented in this book, the instrumentation suite should include the following:

- A three-axis high sensitivity magnetometer
- Ballistic and theodolite cameras
- A high-speed, high-resolution spectrometer
- A passive optical ranging system
- A means of synchronizing the data collected from all instruments.

Magnetometer

The magnetometer should have a sensitivity of the order of 0.1 Gamma, in order to detect the UFO field at a range of about one kilometer. It should include three sensors to detect the three orthogonal components of the field lying in the magnetic north/south, east/west, and vertical directions. It should be capable of measuring time variations in the magnetic field to the degree possible without sacrificing sensitivity. That is, the integration time should not be too long so as to obscure time variations in the field which might be highly diagnostic. Ideally, the integration time should be selectable by the operator in the field. The data collected should be stored in digital form on magnetic tape and disc media. The disc will allow instant replays of the data for verification, whereas the tape will provide shielded/protected archival storage.

Cameras

Several types of cameras are recommended for the portable UFO observatory. One type is a ballistic camera; a relatively simple system for large-angle coverage. Theodolite cameras separated by a baseline distance of approximately a hundred meters would give both high magnification, passive ranging, and even trajectory as a function of time. These would have to be manually operated, with automatic tracking at night a remote possibility. These cameras would benefit from the use of deep red filters to cut through atmospheric haze. As mentioned above, the camera should be designed to ensure that each frame of film passes into a lead shielded magazine immediately after being exposed.

Spectrometer

Based on the theory advanced in this book, it is vital to make a spectral analysis of the light emitted by the UFO. This could give information about the combustion process, the exhaust material, the magnetic field in the vicinity of the vehicle, and essentially prove the theory. The spectrograph will be specifically designed to examine those spectral regions which characterize the elements predicted by the theory. The output could be stored on film for archival purposes, and analyzed in real time using digitally scanned diode arrays, with the output stored on magnetic tape. The magnetic tape must be immediately shielded to provide protection against UFO "scrubbing" passes.

Sonic/Ultrasonic Detectors

Based on a number of sightings involving agitated states of animals and reports of humming sounds, sonic and ultrasonic detectors might be useful in detecting UFOs and possibly in correlating the sounds generated with the maneuvering of the vehicle in flight. The detected signals would be recorded and analyzed using Fourier methods.

Range Finder

A passive optical range finder, such as the type used for decades in the military, would provide a backup for the theodolite system because it is completely passive, simple, and reliable. Such a device could be modified to produce a digital output for synchronized data collection.

Data Collection

A digital clock must be included to synchronize all collected data. If all data could be put on digital magnetic tape, say, twenty times per second, then the association of the various data fields would establish their concurrency. However, some of the data will be in other forms, such as photographs and sonic/ultrasonic recordings, and a means must be included to synchronize these with the digital data being collected at the same instant. In the photographic case, this can be done using commercially available LED arrays whose output characters can be superimposed optically on each frame of film.

UFO Electromagnetic Signature

Based on the theory developed herein we predict the total "signature" of the UFO to be a rich one, admitting a number of coincident measurements with a variety of different instruments. The problem of getting the observatory into the vicinity of UFO sightings is a difficult one, but the implications of a single positive verification are so staggering that we should be undaunted. It is not an exaggeration to say that the proof that UFOs are intelligently controlled vehicles from another star system would be the single most important discovery that mankind has made in its entire history.

THE EXPERIMENTAL APPROACH

The second approach to verification of this theory is experimental as opposed to observational. The idea is to proceed immediately to the laboratory and test the novel physical phenomena which are hypothesized as part of the theory. The following experiments are conceivable:

- Explosive pumping of a superconducting current loop

- Current circulating modes in a toroidal superconducting configuration
- Initiation of superconducting currents in closed loops using natural lightning discharges
- Computer simulations of proposed UFO flight and control systems.

Explosive Pumping of Current Loop

Explosive pumping of current loops is crucial to verifying the UFO power source. It also has potential applications in the area of power generation and military beam weapons. It probably could be done using chemical explosions as opposed to fusion reactions. Although the kinetic energy of the charged particles resulting from a chemical detonation of, say, hydrogen and oxygen, would be far less than that from a fusion reaction, it should be possible to fabricate a small-scale experiment using a ring of superconducting material only an inch or two in diameter which could demonstrate the principle. A current will somehow have to be initiated in the loop prior to running this experiment since the process cannot bootstrap itself from zero.

Proving this principle and exploring its practical limitations is the highest-priority experiment because of its application to the field of energy generation. The configuration suggested for the UFO could essentially be used for a (stationary) controlled fusion reactor, that is, a storage ring surrounding a fusion chamber in which a pulsed reaction is initiated. The magnetic field created by the current in the ring provides the means by which the kinetic energy of the charged combustion products is extracted by Faraday induction. A secondary coil would be used to extract current from the main loop as shown in Figure 6-1.

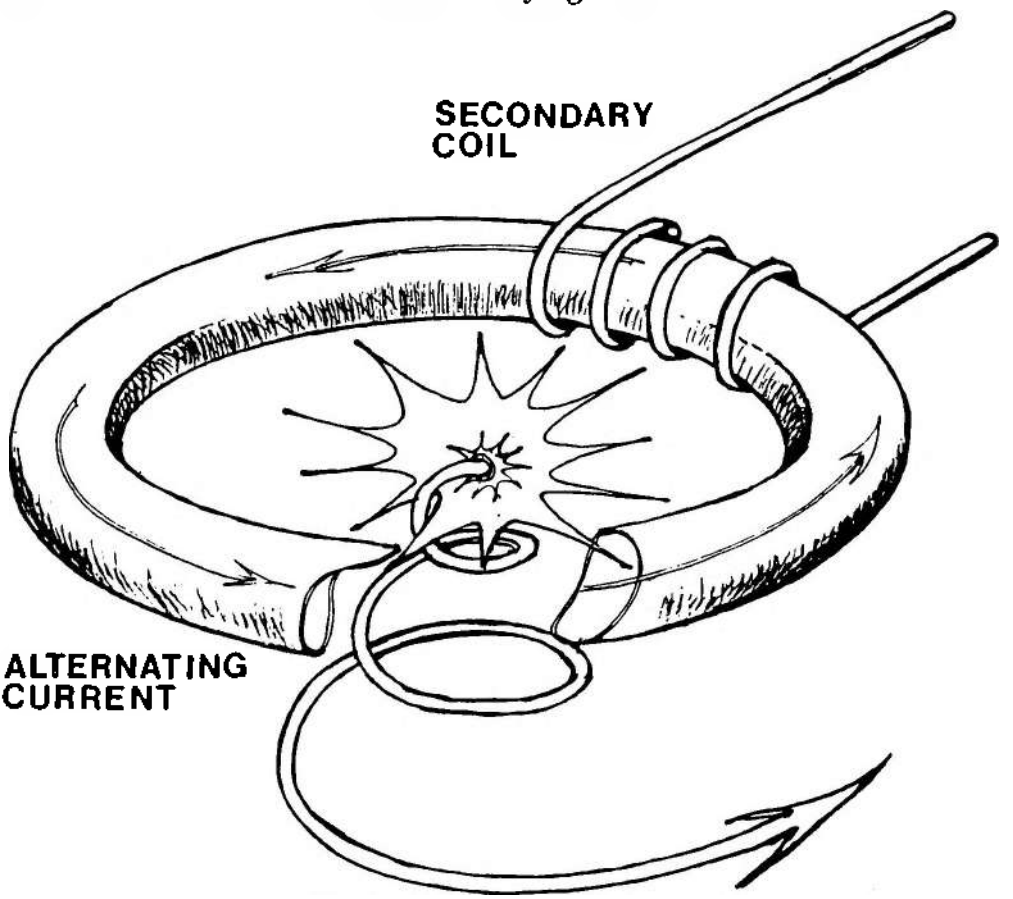


Figure 6-1: Extraction of electrical energy from the main loop using a transformer.

As mentioned above, the fusion reactions would be transient in nature, as with the laser and particle-beam techniques presently under investigation. The steady state or continuously burning reactor is the other type. Work on controlled fusion around the world is split between the two, with devices of the Tokomac type predominating in steady state camp and laser-beam and ion-beam devices predominating in the transient camp. Transient devices have the attractive feature that energy loss problems are minimized and have a large output dynamic range since they only have to be "fired" as often as necessary, depending on the demand. Although our present efforts with

laser beam implosion require a large facility, the promise of the theory developed herein is for devices so modest in size that they can be used to power individual vehicles. This prognostication is in direct opposition to the present trend within the fusion energy establishment, which predicts that reactors will have to be very large in order to be economically feasible.

This is a critical period in the planning of our national priorities for the development of future energy sources. Commitments made today, if based on incorrect assumptions about the eventual size and complexity of fusion energy systems, could lead us into undesirable paths such as breeder reactors. The faster we can shed more light on the eventual form of the fusion power plant, the quicker we can make enlightened plans in this area, saving both money and future generations from the dangers inherent in plutonium breeders.

Current Circulating Modes in a Superconducting Toroid

Another area of interest is that of superconductive current flow in single "fat" toroids, designed with a view to getting maximum current and minimum weight, while maintaining the superconducting state. No work is presently being done in the USA on fat single-loop toroids, as far as the author knows. Attempts were made in past years to wrap superconducting tape in the surface of tubes but this technique proved unsuccessful. Recently researchers have succeeded in depositing thin layers of the new superconductors in a vacuum, resulting in very high current densities.

Computer Simulation of Proposed UFO Flight

Computer simulations of the proposed UFO flight and control systems can be carried out to prove feasibility and

determine if the proposed combination of control mechanisms can indeed produce a stable flying machine.

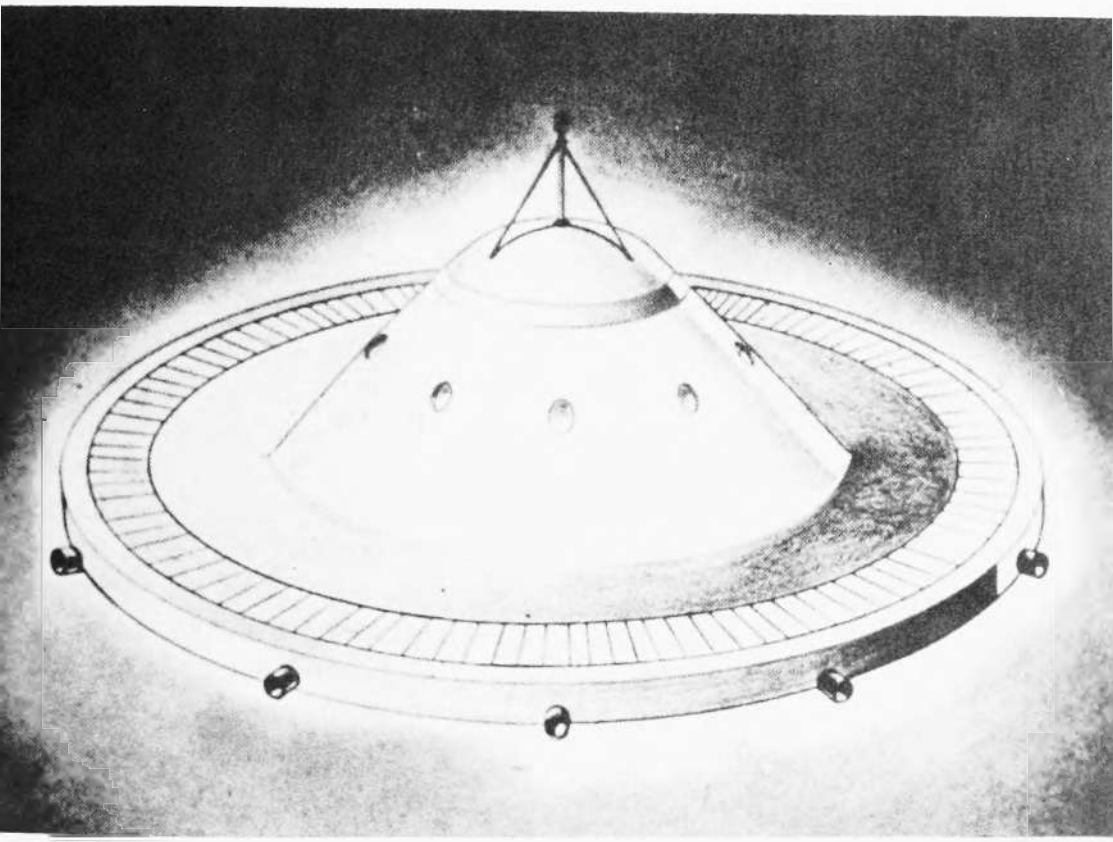
Lightning Experiments

The primary impetus for these experiments is to study the possibility that "superconductivity" may exist in free space. This is hinted at in the natural phenomenon known as ball lightning. The theory is that the primary lightning bolt ionizes air near its strike point and initiates a circulation of this plasma by the the same Faraday induction scheme hypothesized for the UFO power system. The self-generated magnetic field of the plasma loop is reentrant and stable. There are suggestions in the literature concerning plasmas used in experimental fusion work, that a plasma behaves in many ways similarly to a superconductor. Electron pairing may occur with the free protons playing a role similar to the lattice ions in a solid superconductor. Of course the speed of the conventional superconducting electrons is vastly smaller than those in a hot plasma.

Since ball lightning has never been artificially generated, it seems obvious that the energy threshold required to initiate it has not been attained in the laboratory. It would be logical then to utilize natural lightning and prepare a site which optimizes the conditions which would favor its initiation, based on our theory. An annulus of preionized gas (plasma) could be placed at the strike point and a tower arranged to capture the bolts and direct the discharge to the desired point. Ancillary magnetic fields could be generated artificially to further enhance the probability of the phenomenon.

If it can be proven that a super-current can circulate in a plasma with or without the need for massive magnets, it would have profound implications on the proposed design of the UFO. Also it would increase the probability of a tie between the Faraday pumping process and other natural phenomena, such as driving spiral galaxies. This experiment would be rela-

tively straightforward and inexpensive to perform and the results extremely interesting.



Drawing of a UFO observed by two civilian mechanics at Holloman Air Force Base in July of 1958. Object hovered and wobbled only a few feet off the ground at a distance of 150 yards. Also observed by Air Force personnel and air controllers (Courtesy of Mutual UFO Network, Inc., - MUFON).

CONCLUSION

It is our opinion that the enormous advances in technology which would be required to build the proposed UFO can be greatly accelerated by virtue of the theory which helps define the crucial areas. Because progress in superconductive materials and theory was painfully slow over the last few decades, it seemed almost ludicrous to propose the orders-of-magnitude increase needed for the proposed UFO. However, given the recent advances in this field and the continuing high level of activity, there is good reason now to be optimistic in this area. Also, we believe that real progress in materials will come as a result of increased understanding and utilization of powerful magnetic fields in the fabrication process, e.g. the casting of pre-stressed metals and superconductors within high magnetic fields, and perhaps in the absence of gravity. If this proves true, the gains in the field of fabrication techniques will allow stronger fields to be generated which, in turn, will allow better materials to be created, and so on, until the final goal is reached.

The fact of the matter is that if a flying disc were found intact today, our best scientists would not be able to determine how it functions and could not duplicate the materials of which it was constructed.

The question is, how long can we afford to remain ignorant in these matters? The author believes that a modest but long-term commitment should be made to begin this work. The argument is often made that UFO research is a wasted effort - that nothing useful could be learned from studying such a specula-

tive subject. We believe that the concepts presented in this book are sufficient to refute that claim. If we decide to proceed with the proposed effort, the next question is whether we should spend our energy trying to "capture" the elusive UFO or whether we should set up an experimental program to prove the critical concepts using the clues as they now stand. The answer is that we should pursue the solution on all fronts, since any corroboration obtained from actual observations will strengthen our resolve as well as our experimental data, and may shorten that work. Of course, the development of appropriate materials, the demonstration of the correctness of our ideas, and the fabrication of experimental models must be done in the laboratory, always keeping the theoretical framework in mind, but with a willingness to modify it when experiment dictates.

It is a long-term development and as a result will require government or institutional support, since the private sector generally cannot support projects with a payoff time of more than five years. In spite of this, enthusiasm should remain high, if we can keep in mind the potential and the implications of this work for the future.

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Page 135 Drawing of a UFO observed by two civilian mechanics at Holloman Air Force Base in July of 1958. Object hovered and wobbled only a few feet off the ground at a distance of 150 yards. Also observed by Air Force personnel and air controllers (Courtesy of Mutual UFO Network, Inc. - MUFON).

Being conditioned to an institutionalized society, we tend to expect a "ruling" from the government and from the church as to how we should fit any new revolutionary concept into the fabric of our everyday lives. But the UFOs are already conditioning us as to their existence by allowing us to observe them on a regular basis. The time has come to accept the high probability that our planet is now and has been regularly visited by more intelligent beings - even before the present period of recorded history - and to accept the consequences of this idea.

This book reasons, by virtue of the mass of detailed sightings, that UFOs are alien spacecraft from other worlds. So far the ruling on UFOs has been that they are not real. But this is not the primary thrust. It then proceeds to construct a theory of how they fly, using the scientific method. As a result of deduction based on a multitude of observations combined with induction based on our current knowledge of physics, the theory that evolves results in a fascinating design of a space ship, including the methodology for levitation, stabilization, and power source. This theory is presented in terms that any college graduate can comprehend.

It provides the means of its own verification, by suggesting specific observations, both at short and long ranges. It also suggests fields in which we can direct our experimental and theoretical work here on earth to bring us closer to building our own advanced spacecraft.

The author, John Ackerman, is a physicist who has spent many years as a physicist/engineer in the aerospace industry.

ABOUT THE BOOK

This remarkable book by an aerospace physicist is based on numerous reported sightings of UFOs. The author uses deductive and inductive scientific reasoning to evolve a fascinating design of a space ship including methodology for levitation, stabilization and power source. Never before has any engineer set forth the physical principles that could explain the motion, flight patterns, and propulsion capabilities of the many UFOs sighted in recent years. This book is a first to foresee the possible development of our own future space propulsion systems.

ABOUT THE AUTHOR

The author, John Ackerman, has a bachelor's degree in physics from Drexel University and a master's degree also in physics from Johns Hopkins University. His experience includes many years in electro-optical systems, automation of airborne surveys of the magnetic and radiometric fields of the earth and classified ASW programs. He is currently with General Electric as an aerospace engineer.

Mr. Ackerman's interest in UFOs spans some twenty years over which time the ideas presented in this book evolved. The decision to publish the theory was prompted by the lack of any published theory that would form the basis for a rational dialogue on UFOs.